



# OmniChat

BY OCTOPUS DIGITAL LIMITED

## User Requirements Specification

## Table of Contents

<b>2. Introduction.....</b>	<b>5</b>
<b>  2.1. Executive Summary.....</b>	<b>5</b>
<b>3. User Requirements .....</b>	<b>6</b>
<b>  3.1. Functional Requirements .....</b>	<b>6</b>
<b>    3.1.1. Adhoc Visualization .....</b>	<b>6</b>
<b>      3.1.1.1. Automatic Conversation Creation .....</b>	<b>6</b>
<b>      3.1.1.2. Dataset Management .....</b>	<b>6</b>
<b>      3.1.1.3. Conversation Persistence .....</b>	<b>6</b>
<b>      3.1.1.5. Frequently Asked Questions (FAQs) .....</b>	<b>11</b>
<b>      3.1.1.6. Conversation Management.....</b>	<b>11</b>
<b>      3.1.1.7. Favorites Functionality .....</b>	<b>12</b>
<b>      3.1.1.8. Like and Dislike Functionality:.....</b>	<b>12</b>
<b>      3.1.1.9. New Chat Button .....</b>	<b>12</b>
<b>      3.1.1.11. Add to Dashboard Functionality .....</b>	<b>14</b>
<b>      3.1.1.12. Hide Sidebar Functionality .....</b>	<b>14</b>
<b>    3.1.2.3. Correlation Heatmap .....</b>	<b>16</b>
<b>    3.1.3.1. Adding Interactive Plots .....</b>	<b>20</b>
<b>    3.1.3.3. Customizable Layout.....</b>	<b>26</b>
<b>    3.1.3.4. Arranging Plots on the Dashboard .....</b>	<b>26</b>
<b>    3.1.3.5. Interacting with IoT/OT/Sensors Data.....</b>	<b>27</b>
<b>    3.1.3.6. Creating New Dashboards.....</b>	<b>27</b>
<b>  3.1.4.1. Dataset Selection .....</b>	<b>28</b>
<b>  3.1.4.2. Attribute Selection .....</b>	<b>28</b>
<b>  3.1.4.3. AutoML Forecasting Process .....</b>	<b>28</b>
<b>  3.1.4.4. Confusion Matrix .....</b>	<b>28</b>
<b>  3.1.4.6. ML Model Decision Making .....</b>	<b>28</b>
<b>3.1.5. Asset Hierarchy for OT/Sensor Data.....</b>	<b>29</b>



3.1.5.1. Data Integration via OmniConnect Read API.....	29
3.1.5.2. Hierarchical Visualization.....	29
3.1.5.3. Interactive Node Information .....	30
3.1.5.4. Expandable and Collapsible Nodes.....	32
3.1.5.5. User Interface Controls .....	32
3.1.5.6. Folder View Popover.....	33
3.1.5.7. Focus Mode .....	33
3.1.6. Authentication, Security, and Configuration Management .....	34
3.2. Non-Functional Requirements .....	36
3.2.1. Interface Requirements.....	36
3.2.2. Availability Requirements .....	36
3.2.3. Security Requirements.....	36
3.2.4. Performance Requirements .....	36

## 1. Definitions

For the purpose of this User Requirements Specification (URS), the following definitions apply:

TERM	DESCRIPTION
<b>OmniChat</b>	A generative Artificial Intelligence (AI) solution that enables natural language-driven data analysis and visualization.
<b>OmniAgent</b>	The interactive assistant within OmniChat that responds to user queries and commands using natural language processing.
<b>OmniConnect</b>	The integration platform that migrates OT/Sensor Data to various data sources and systems for seamless data access.
<b>OmniConnect Read API</b>	An API provided by OmniConnect to fetch datasets, tenant information, and configurations for OmniChat.
<b>Natural Language Interface (NLI)</b>	An OmniChat interface that allows users to interact with a system using natural language commands and queries.
<b>LLMs (Large Language Models)</b>	Advanced AI models capable of understanding and generating human-like text, used for natural language processing.
<b>Data Sources</b>	Various origins of data such as databases, spreadsheets, cloud platforms, and specialized storage solutions.
<b>BI (Business Intelligence)</b>	Technologies and strategies used by enterprises for data analysis and business information delivery.
<b>Machine Learning Models</b>	Algorithms and statistical models used by computers to perform tasks without explicit instructions.
<b>AI (Artificial Intelligence)</b>	The simulation of human intelligence in machines that can perform tasks autonomously.
<b>EDA</b>	Exploratory Data Analysis, an approach to analyzing data sets to summarize their main characteristics.
<b>UI</b>	User Interface, the point of interaction between the user and a digital device or software.
<b>UX</b>	User Experience, the overall experience of a person using a product, especially in terms of how easy and pleasant it is to use.
<b>IoT Devices</b>	Physical objects embedded with sensors, software, and other technologies to connect and exchange data with other devices and systems over the internet.
<b>OT</b>	Operational Technology, hardware and software that detects or causes changes through direct monitoring and control of physical devices.
<b>ML</b>	Machine Learning, a subset of AI that involves the development of algorithms that can learn and make predictions from data.
<b>ML Models</b>	Algorithms designed to identify patterns and make decisions based on data inputs.
<b>OPC</b>	OLE for Process Control, a standard for industrial automation interoperability.



<b>NLP (Natural Language Processing)</b>	A field of AI that focuses on the interaction between computers and humans through natural language.
<b>Prompt Engineering</b>	The practice of designing and refining prompts to improve the performance and output of LLMs and other AI systems.
<b>Train OmniChat</b>	The process of feeding OmniChat with data to improve its accuracy and performance in responding to user queries.
<b>Fine Tuning OmniChat</b>	Adjusting the parameters of OmniChat to enhance its capabilities and accuracy for specific tasks or datasets.
<b>Context Memory of OmniChat</b>	The ability of OmniChat to retain and use information from previous interactions to provide more relevant responses.
<b>Python</b>	A high-level programming language widely used for developing applications, especially in data science and machine learning.



## 2. Introduction

### 2.1. Executive Summary

Data is the new oil, and its strategic analysis is critical for businesses aiming to optimize operations and reduce costs. Traditional methods of data analysis can be cumbersome and slow, involving manual data collection, complex data integration, and extensive preprocessing. These processes require detailed technical expertise and are time-consuming, hindering timely decision-making and impeding business growth. Traditional Business Intelligence (BI) tools often have steep learning curves and rigid interfaces, requiring advanced technical skills for meaningful visualizations and reports. This reliance on IT or data science teams for basic queries creates bottlenecks, delaying access to critical insights and reducing operational efficiency.

OmniChat, our generative Artificial Intelligence (AI) solution, addresses these challenges by providing a seamless, natural language interface for data analysis. By integrating with various data sources and leveraging the OmniChat Read API, the system ensures effortless data access and retrieval, eliminating complex data engineering tasks. Users can interact with their data using intuitive natural language commands, enabling ad-hoc analysis, generating insightful visualizations, and making real-time decisions with ease. This approach supports a data-driven culture, enhances operational efficiency, reduces technical dependencies, and drives sustainable growth and competitive advantage. OmniChat revolutionizes visualizations by utilizing Large Language Models (LLMs) to generate flexible and dynamic data interpretations, transforming the way businesses harness the power of their data.

The core objective of implementing OmniChat is to democratize data analysis, making it accessible to all users regardless of their technical background. Decision-makers and operators in the OT world, who are often non-technical, require ad-hoc and real-time analysis to make informed and actionable decisions quickly. OmniChat leverages LLMs to create, modify, and interpret visualizations in real-time, providing deeper insights and a more flexible approach to data analysis. By making sophisticated BI tools accessible and effective for all users, OmniChat is poised to transform how businesses harness the power of their data, fostering agile decision-making processes and supporting sustainable growth.

### 3. User Requirements

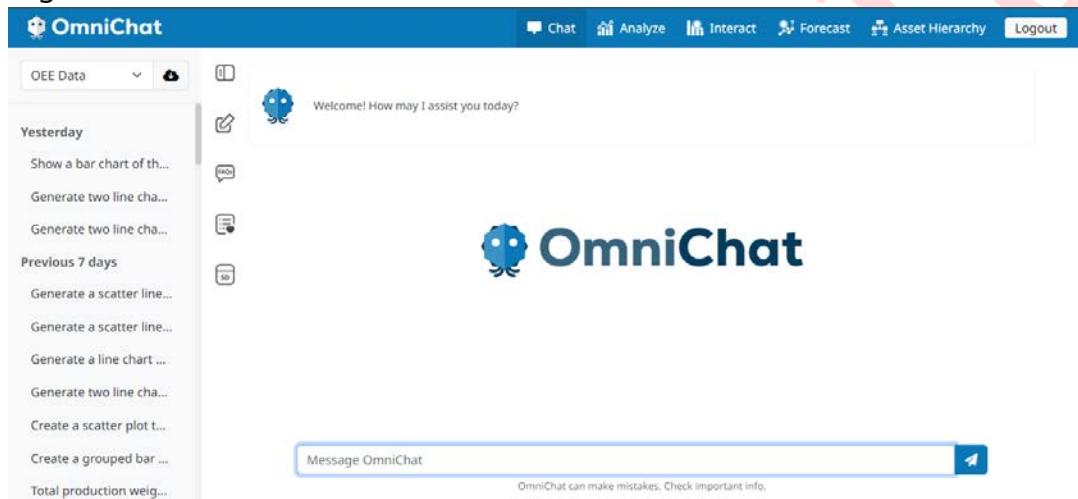
#### 3.1. Functional Requirements

##### 3.1.1. Adhoc Visualization

The Chat page of OmniChat is designed to facilitate seamless and intuitive interactions between users and OmniAgent. This page is central to the user experience, offering a range of functionalities to enhance communication and data analysis.

###### 3.1.1.1. Automatic Conversation Creation

- A new chat conversation is created each time a user logs in, maintaining a clear and organized structure for conversations.



###### 3.1.1.2. Dataset Management

- Users can switch between different datasets such as Plant Data, Finance Data, or SAP Data.
- The selected dataset can be refreshed at any time using the OmniConnect Read API, ensuring users always have access to the latest information.

###### 3.1.1.3. Conversation Persistence

For each new conversation, the following parameters are stored in the database:

- **Prompt:** The system shall accept an initial query or message input by the user in English and always store in databases. It includes the exact text of the user's query



along with any specific instructions or context provided.

A screenshot of the OmniChat application. At the top, there's a navigation bar with icons for Chat, Analyze, Dashboard, Forecast, Asset Hierarchy, and Logout. Below the navigation bar, there's a sidebar with a "OEE Data" dropdown and a "Today" section containing various tasks like "Generate a box plot for the ...". The main area shows a conversation between a user and OmniChat. The user has sent a message: "Please analyze the trend in good pieces production over time for a Karachi plant." OmniChat is currently generating a response, indicated by a blue progress bar. A callout bubble points to the progress bar with the text "Loading style when OmniChat is generating your response...".

Welcome! How may I assist you today?

Please analyze the trend in good pieces production over time for a Karachi plant.

Loading style when OmniChat is generating your response...

- **Response:** The system shall generate responses using Large Language Model (LLM) and Natural Language Processing (NLP) capabilities, which may include tables, images, or text responses.

A screenshot of the OmniChat application showing the generated response. The user's message "Please analyze the trend in good pieces production over time for a Karachi plant." is shown, followed by a speech bubble from OmniChat stating "Response generated by OmniChat". Below the text, a line graph titled "Trend in Goodpieces Production Over Time for Karachi Plant" is displayed. The graph plots "Goodpieces Production" against "Shift Date", showing a fluctuating trend over time. The Y-axis ranges from 0 to 7, and the X-axis shows dates from March 2024 to July 2024.

Please analyze the trend in good pieces production over time for a Karachi plant.

Response generated by OmniChat

Trend in Goodpieces Production Over Time for Karachi Plant

Goodpieces Production

Shift Date



OmniChat

Chat Analyze Dashboard Forecast Asset Hierarchy Log

OEE Data

Display cases where idle stoppages exceed 7 minutes for work center BIBK01.

Generate a scatter plot ...

Yesterday

FAQs SD

Plant Shift Date Shift Status SAP Order WorkCenter WorkCenter Type Ingest Order

Plant	Shift Date	Shift Status	SAP Order	WorkCenter	WorkCenter Type	Ingest Order
Lahore	2024-03-01 00:00:00+00:00	Morning	2196933	BIBR06	Hard Pack	No
Lahore	2024-03-01 00:00:00+00:00	Morning	2196928	BIBR01	Hard Pack	No
Lahore	2024-03-01 00:00:00+00:00	Morning	2196936	FS6LR01	Pillow Pack	No
Lahore	2024-03-01 00:00:00+00:00	Morning	2196944	FS6LR03	Pillow Pack	No
Lahore	2024-03-01 00:00:00+00:00	Morning	2196960	MSR06	Tea Bag	No
Lahore	2024-03-01 00:00:00+00:00	Evening	2196936	FS6LR01	Pillow Pack	Yes
Karachi	2024-03-01 00:00:00+00:00	Evening	2196911	FS5LK01	Pillow Pack	Yes
Lahore	2024-03-01 00:00:00+00:00	Evening	2196959	MSR05	Tea Bag	Yes
Lahore	2024-03-01 00:00:00+00:00	Morning	2196941	FS5LR04	Pillow Pack	No

Chat Analyze Dashboard Forecast Asset Hierarchy

Welcome! How may I assist you today?

What is the average OEE for BIBK01

Textual Response Generated by OmniChat

Response: 82.065

Explanation: I looked at the data we have and found the average OEE for a specific work center called BIBK01. I then wrote a code that calculates this average OEE by filtering the data for that specific work center and calculating the mean value. This code will help us easily find and track the average OEE for BIBK01 without having to manually calculate it each time.

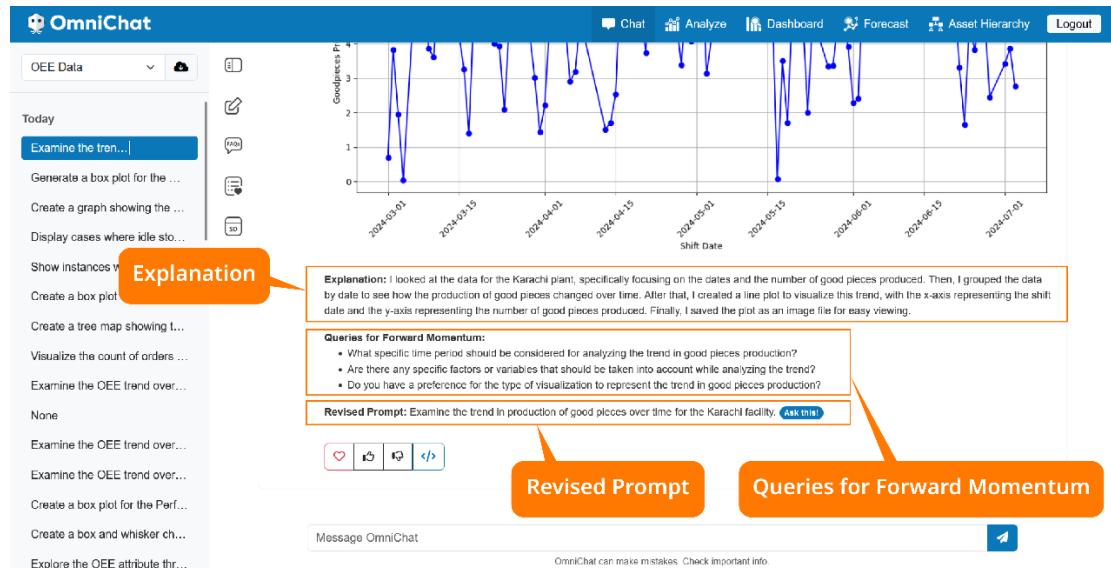
Queries for Forward Momentum:

- Are you looking for the average OEE for a specific date range or shift?
- Do you want the average OEE for a specific shift or all shifts combined?
- Is there a specific time period or condition you want to consider for calculating the average OEE?

Revised Prompt: What is the average Overall Equipment Effectiveness for BIBK01? [Ask this!](#)

- Explanation:** A detailed explanation of the logic, reasoning, or methodology used to generate the response. The explanation shall be generated using Large Language Model (LLM) capabilities.
- Queries for Forward Momentum:** A set of follow-up questions designed to continue and deepen the conversation. This includes at least three follow-up queries that are contextually relevant and aimed at maintaining the engagement and flow of the conversation.
- Revised Prompt:** A refined version of the user's original query to improve clarity and optimize the prompt for the LLM. The revised prompt includes adjustments for clarity, specificity, and context to enhance the effectiveness of the system's response generation.
- Prompt Engineering:** It involves designing and refining input prompts to optimize the responses generated by language models. It includes structuring queries to be clear,

specific, and contextually rich, ensuring that the model understands and processes the input effectively. Good prompt engineering can significantly enhance the relevance and accuracy of the model's outputs, leading to more meaningful and useful interactions.



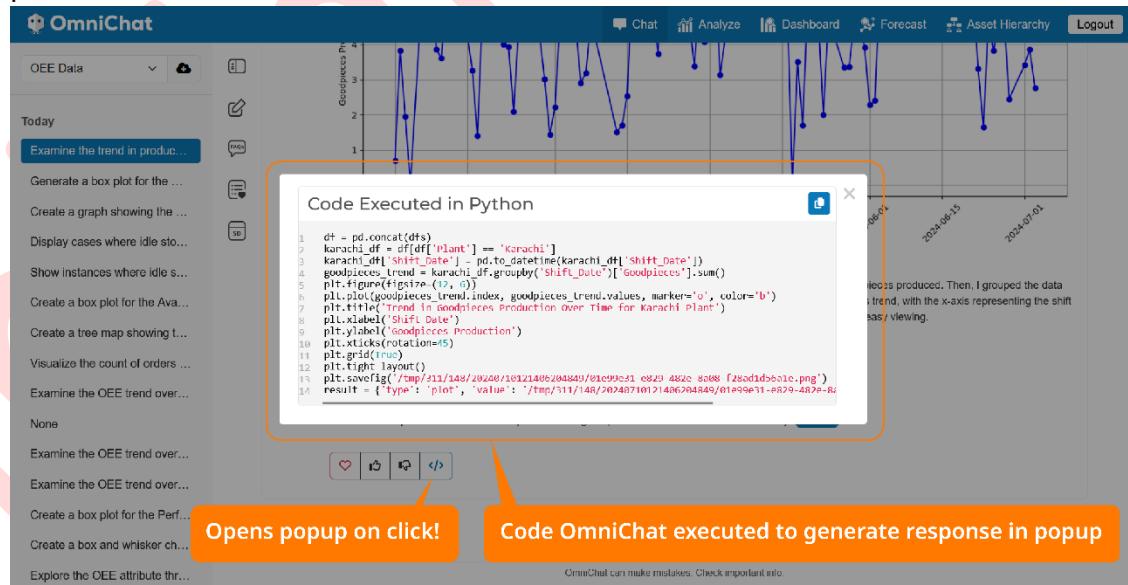
**Explanation:** I looked at the data for the Karachi plant, specifically focusing on the dates and the number of good pieces produced. Then, I grouped the data by date to see how the production of good pieces changed over time. After that, I created a line plot to visualize this trend, with the x-axis representing the shift date and the y-axis representing the number of good pieces produced. Finally, I saved the plot as an image file for easy viewing.

**Revised Prompt:** Examine the trend in production of good pieces over time for the Karachi facility. [Ask this](#)

**Queries for Forward Momentum:**

- What specific time period should be considered for analyzing the trend in good pieces production?
- Are there any specific factors or variables that should be taken into account while analyzing the trend?
- Do you have a preference for the type of visualization to represent the trend in good pieces production?

- **Executed Code:** The actual Python code executed to produce the result, especially relevant for queries that involve data processing, analysis, or visualization. This includes the full Python script or code snippet executed, including any libraries used, parameters set, and results obtained from the execution.



```

1: df = pd.concat(dfs)
2: karachi_df['Plant'] = 'Karachi'
3: karachi_df['Shift Date'] = pd.to_datetime(karachi_df['Shift Date'])
4: goodpieces_trend = karachi_df.groupby('Shift Date')['Goodpieces'].sum()
5: plt.figure(figsize=(12, 6))
6: plt.plot(goodpieces_trend.index, goodpieces_trend.values, marker='o', color='blue')
7: plt.title('Trend in Goodpieces Production Over Time for Karachi Plant')
8: plt.xlabel('Shift Date')
9: plt.ylabel('Goodpieces Production')
10: plt.xticks(rotation=45)
11: plt.grid(True)
12: plt.tight_layout()
13: plt.savefig('/tmp/111/148/2024/10/21/1405/04849/01c99c81_e829_482c_ae08_f280d1db5b1c.png')
14: result = {type: 'plot', value: '/tmp/111/148/2024/10/21/1405/04849/01c99c81_e829_482c_ae08_f280d1db5b1c.png'}

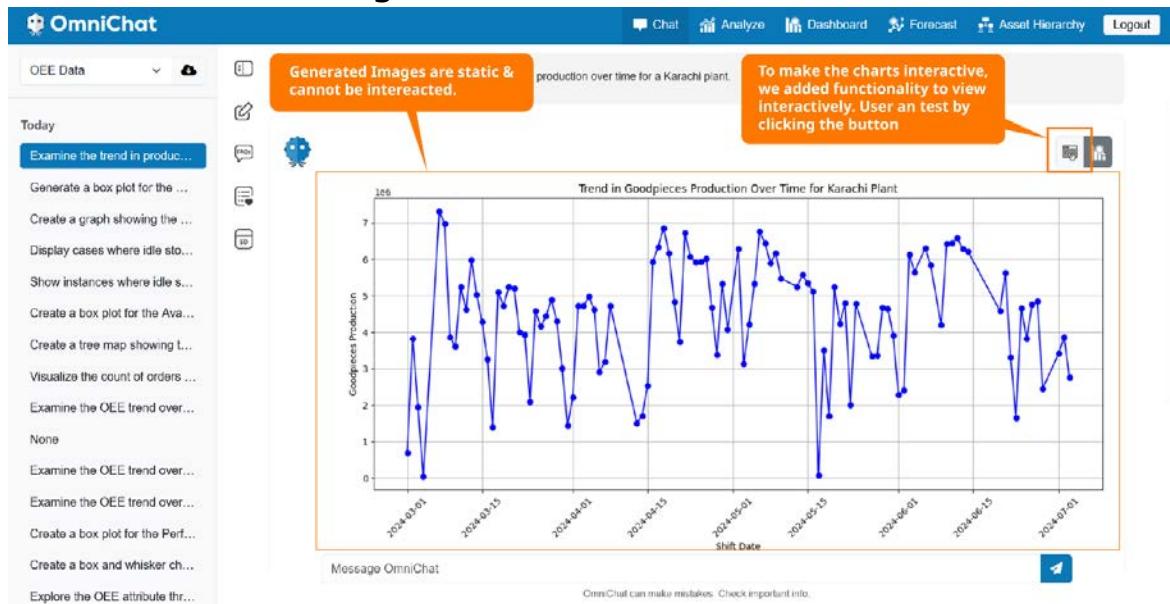
```

**Code Executed in Python:**

**Opens popup on click!**

**Code OmniChat executed to generate response in popup**

### 3.1.1.4. Interactive Plot Viewing



Users can view static images generated by OmniChat as interactive plots on the same screen, with functionalities such as:

- Zoom In and Zoom Out
- View Details on Hover



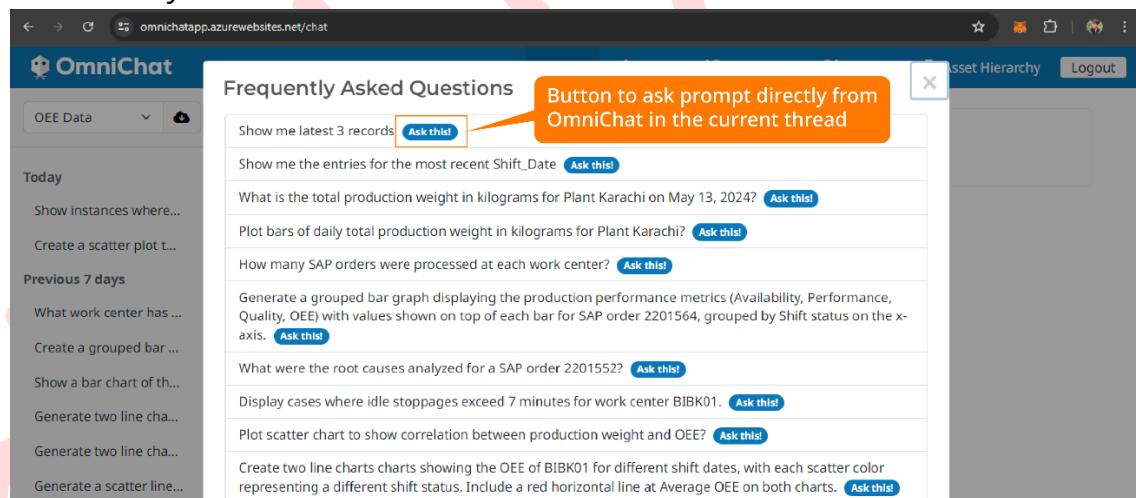
- Pan within the plot space

- Custom horizontal and vertical window for zoomed analysis



### 3.1.1.5. Frequently Asked Questions (FAQs)

- A list of FAQs is available on the Chat page to help users understand the chatting functionality and make the most out of their interactions with OmniChat.



Frequently Asked Questions

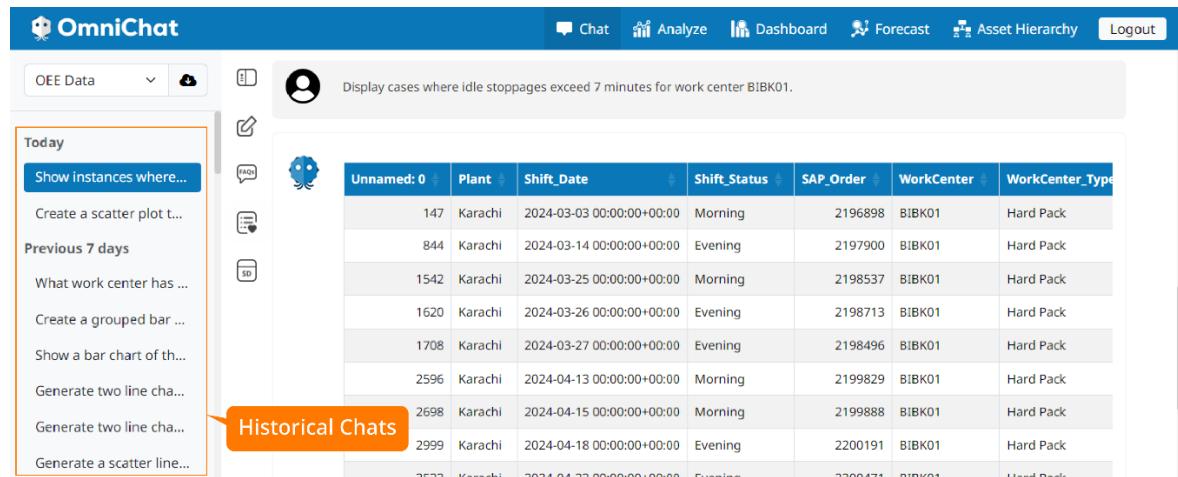
- Show me latest 3 records [Ask this!](#)
- Show me the entries for the most recent Shift\_Date [Ask this!](#)
- What is the total production weight in kilograms for Plant Karachi on May 13, 2024? [Ask this!](#)
- Plot bars of daily total production weight in kilograms for Plant Karachi? [Ask this!](#)
- How many SAP orders were processed at each work center? [Ask this!](#)
- Generate a grouped bar graph displaying the production performance metrics (Availability, Performance, Quality, OEE) with values shown on top of each bar for SAP order 2201564, grouped by Shift status on the x-axis. [Ask this!](#)
- What were the root causes analyzed for a SAP order 2201552? [Ask this!](#)
- Display cases where idle stoppages exceed 7 minutes for work center BIBK01. [Ask this!](#)
- Plot scatter chart to show correlation between production weight and OEE? [Ask this!](#)
- Create two line charts charts showing the OEE of BIBK01 for different shift dates, with each scatter color representing a different shift status. Include a red horizontal line at Average OEE on both charts. [Ask this!](#)

### 3.1.1.6. Conversation Management

Users can revisit and chat in older conversations, which are loaded from the database upon selection. Conversations are organized by:

- Today
- Yesterday
- Previous 7 days
- Previous 30 days
- Month

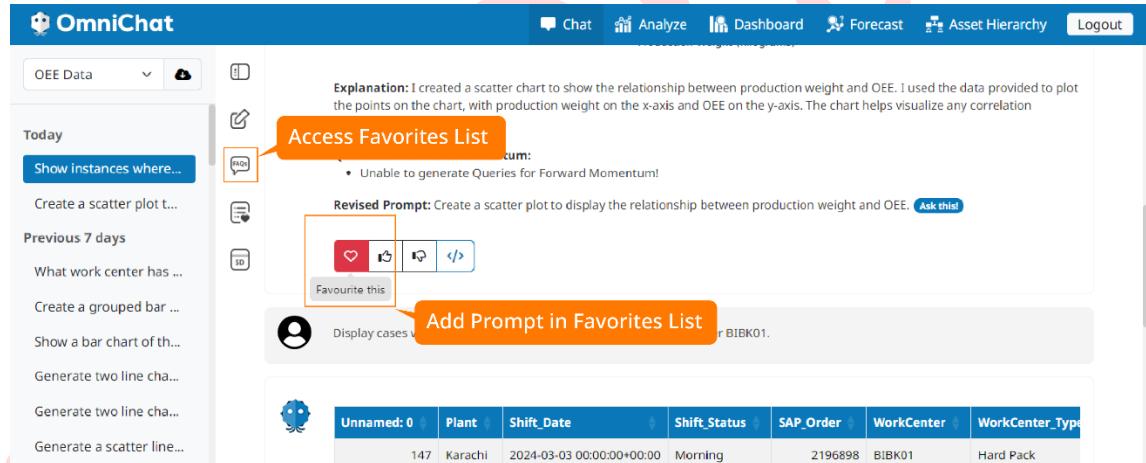
- Year



The screenshot shows the OmniChat interface. On the left, there's a sidebar with a 'Today' section containing various options like 'Show instances where...', 'Create a scatter plot t...', and 'Generate two line cha...'. A callout box labeled 'Historical Chats' points to a list of historical chats on the right. Below the chats is a table with columns: Unnamed: 0, Plant, Shift\_Date, Shift\_Status, SAP\_Order, WorkCenter, and WorkCenter\_Type. The table contains several rows of data.

### 3.1.1.7. Favorites Functionality

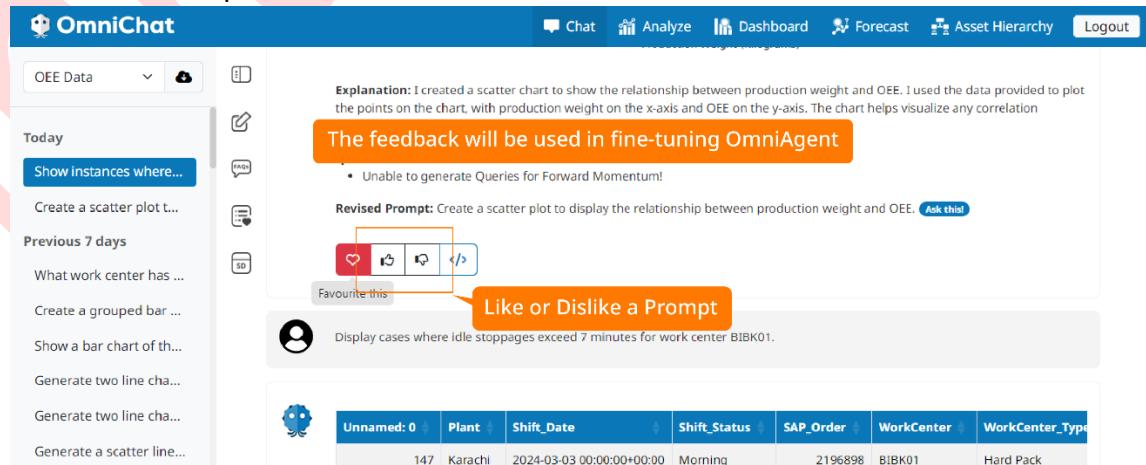
- Users can mark specific prompts as favorites for easy access later.



The screenshot shows the OmniChat interface. A callout box labeled 'Access Favorites List' points to a button labeled 'Favourite this' next to a list of prompts. Another callout box labeled 'Add Prompt in Favorites List' points to the same 'Favourite this' button. The interface also includes an explanation of a previous prompt and a revised prompt.

### 3.1.1.8. Like and Dislike Functionality:

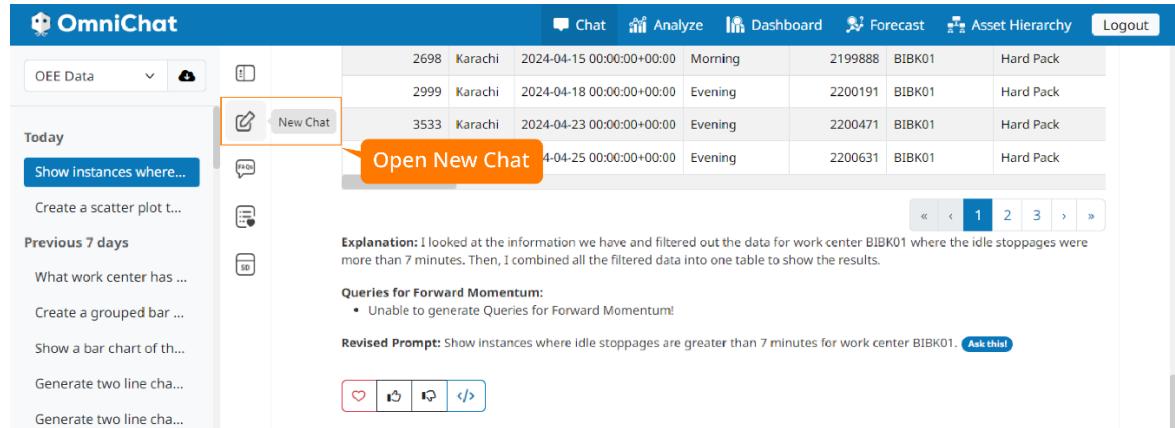
- Users can like or dislike prompts, providing feedback that is used to fine-tune OmniChat's responses.



The screenshot shows the OmniChat interface. A callout box labeled 'Like or Dislike a Prompt' points to a row of icons including a heart (like), a thumbs up (dislike), and a refresh symbol. The interface also includes an explanation of a previous prompt and a revised prompt.

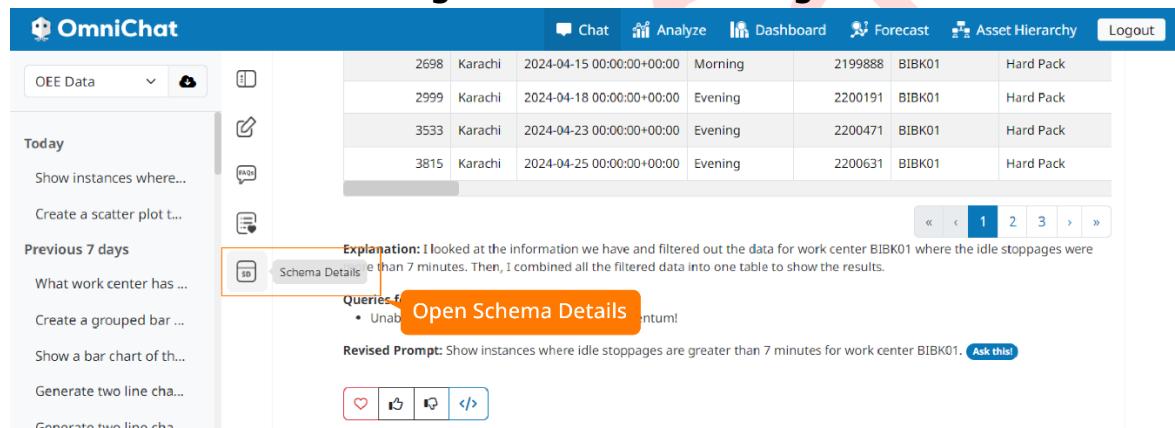
### 3.1.1.9. New Chat Button

- This button allows users to reset OmniChat's context memory and start a new conversation at any time.



The screenshot shows the OmniChat application interface. On the left, there is a sidebar with various options like 'Today', 'Show instances where...', 'Create a scatter plot t...', 'Previous 7 days', etc. In the center, there is a table with data rows. A button labeled 'New Chat' is highlighted with a red box. Below the table, there is a section titled 'Explanation' with some text and a 'Revised Prompt' button. At the bottom, there are several small icons.

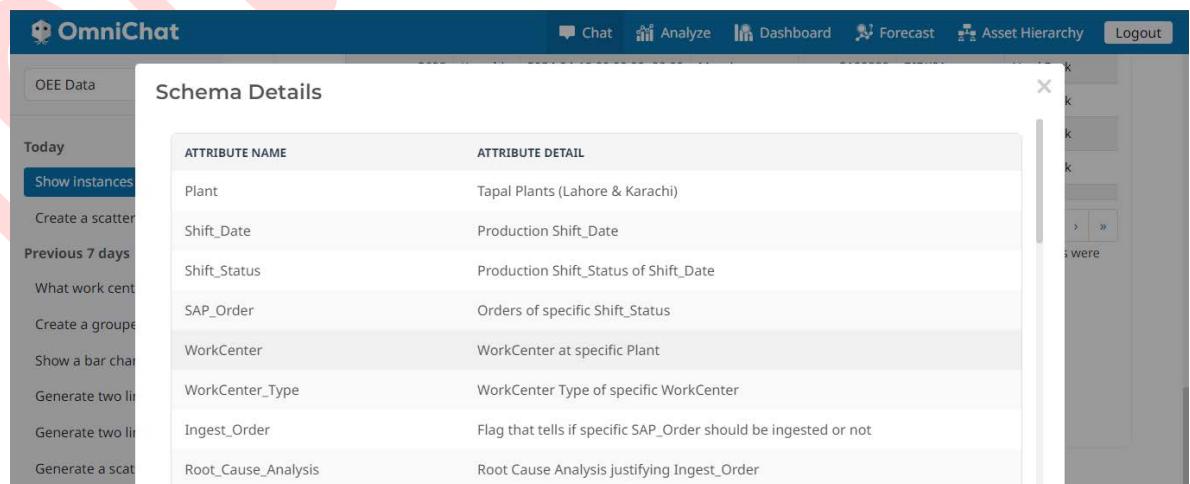
### 3.1.1.10. Schema Details for Training & User Understanding



The screenshot shows the OmniChat application interface. The sidebar and table are similar to the previous screenshot. A button labeled 'Schema Details' is highlighted with a red box. Below the table, there is a section titled 'Explanation' with some text and a 'Revised Prompt' button. At the bottom, there are several small icons.

The system fetches schema details of the selected dataset using the OmniConnect Read API, including:

- Attribute Name: The name or mapped name of the attribute.
- Attribute Detail: A 1-2 sentence business description of the attribute.
- These details are used to train OmniChat.



The screenshot shows the OmniChat application interface with a modal window titled 'Schema Details'. The modal contains a table with two columns: 'ATTRIBUTE NAME' and 'ATTRIBUTE DETAIL'. The data in the table is as follows:

ATTRIBUTE NAME	ATTRIBUTE DETAIL
Plant	Tapal Plants (Lahore & Karachi)
Shift_Date	Production Shift_Date
Shift_Status	Production Shift_Status of Shift_Date
SAP_Order	Orders of specific Shift_Status
WorkCenter	WorkCenter at specific Plant
WorkCenter_Type	WorkCenter Type of specific WorkCenter
Ingest_Order	Flag that tells if specific SAP_Order should be ingested or not
Root_Cause_Analysis	Root Cause Analysis justifying Ingest_Order



### 3.1.1.11. Add to Dashboard Functionality

Users can convert static images generated by OmniChat into interactive plots and add them to the Dashboard Page of the OmniChat app.

A screenshot of the OmniChat interface. At the top, there's a navigation bar with tabs for Chat, Analyze, Dashboard (which is highlighted), Forecast, Asset Hierarchy, and Logout. Below the navigation bar, there's a sidebar with various options like 'OEE Data', 'Plot scatter chart...', 'Today', 'Show instances where...', 'Create a scatter plot ...', 'Previous 7 days', 'What work center has ...', 'Create a grouped bar ...', 'Show a bar chart of th...', 'Generate two line cha...', 'Generate two line cha...', and 'Generate a scatter line...'. To the right of the sidebar is a scatter plot titled 'Correlation between Production Weight and OEE'. The plot shows a positive correlation with data points scattered across a grid. An orange callout box points to a button labeled '+ Add to Dashboard' located in the top right corner of the plot area.

### 3.1.1.12. Hide Sidebar Functionality

Users can use the Toggle Sidebar button to hide it for expanded view.

A screenshot of the OmniChat interface. At the top, there's a navigation bar with tabs for Chat, Analyze, Dashboard, Forecast, Asset Hierarchy, and Logout. Below the navigation bar, there's a sidebar with icons for 'Toggle Sidebar' (highlighted with an orange box), 'FAAH', 'SD', and a user profile icon. A callout box points to the 'Toggle Sidebar' button with the text 'Hide Sidebar for expanded view'. To the right of the sidebar is a table with 10 rows of data. The table has columns for 'Unnamed: 0', 'Plant', 'Shift Date', 'Shift\_Status', 'SAP\_Order', 'WorkCenter', 'WorkCenter\_Type', 'Ingest\_Order', and 'R'. The data shows various shifts at the Karachi plant, with SAP Orders ranging from 147 to 3533. An orange callout box also points to the 'WorkCenter\_Type' column header.



### 3.1.2. Adhoc Analysis

The Analyze Page of OmniChat is dedicated to providing comprehensive Exploratory Data Analysis (EDA) for datasets. This page offers detailed insights and visualizations to help users understand the structure, distribution, and relationships within their data.

#### 3.1.2.1. Dataset Description

The system shall display a detailed description of the dataset on the Analyze Page. This description shall include:

- **Total Records:** The total number of records in the dataset.
- **Total Attributes:** The total number of attributes in the dataset.
- **Total Categorical Attributes:** The number of categorical attributes in the dataset.
- **Total Numerical Attributes:** The number of numerical attributes in the dataset.

A screenshot of the OmniChat Analyze Page. At the top, there's a navigation bar with icons for Chat, Analyze, Dashboard, Forecast, Asset Hierarchy, and Logout. Below the header, the title "Unveiling Insights: Exploratory Data Analysis" is displayed. Underneath, four summary boxes show: "Total Rows: 6806", "Total Columns: 25", "Categorical Columns: 8", and "Numerical Columns: 17". The main content area is divided into two sections: "Dataset EDA" and "Attribute EDA". The "Dataset EDA" section contains buttons for "Statistical Analysis" and "Correlation Heatmap". The "Attribute EDA" section shows a dropdown menu titled "Select Attribute: WorkCenter".

#### 3.1.2.2. Statistical Analysis

The system shall provide a comprehensive statistical analysis of the dataset on the Analyze Page. The analysis shall include:

- **Count of Attributes:** The count of each attribute.
- **Average of Attributes:** The mean or average value of each attribute.
- **Standard Deviation of Attributes:** The standard deviation of each attribute.
- **First Quartile of Attributes:** The first quartile (Q1) value of each attribute.
- **Second Quartile of Attributes:** The median or second quartile (Q2) value of each attribute.
- **Third Quartile of Attributes:** The third quartile (Q3) value of each attribute.
- **Minimum Value of Attributes:** The minimum value of each attribute.

- Maximum Value of Attributes:** The maximum value of each attribute.

Dataset EDA

Statistical Analysis [?](#)

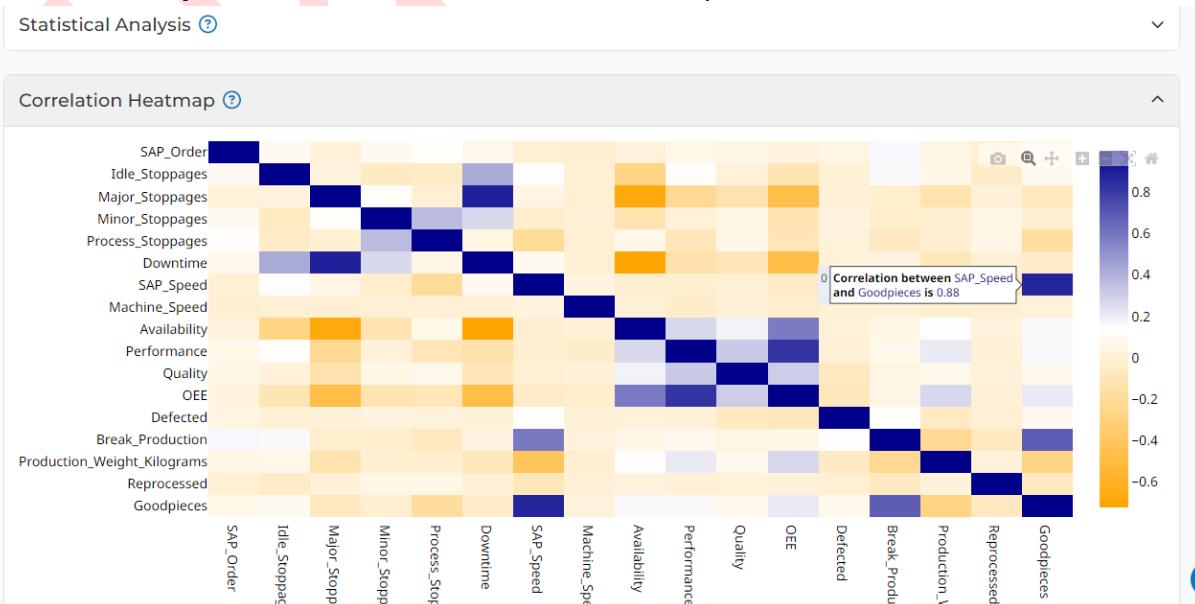
Search Attributes

Attribute	count	mean	std	min	25%	50%	75%	max
SAP_Order	6806	2200485.58	2126.19	2194046	2198718	2200319	2202140	2204844
Idle_Stoppages	6806	13.09	25.56	0	0	3.78	15.06	430.98
Major_Stoppages	6806	20.62	52.72	0	0	0	21.16	595.88
Minor_Stoppages	6805	10.3	11.84	0	0	7.33	14.8	118.01
Process_Stoppages	6806	25.6	23.86	0	9.58	19.03	33.66	251.53
Downtime	6806	44.01	61.25	0	11.32	26.1	53.93	595.88
SAP_Speed	6806	202.11	161.77	8	110	144	350	694
Machine_Speed	6442	320.35	7969.4	0	99	122	287	633810
Availability	6806	89.55	17.59	-344.11	88.68	94.3	97.42	100
Performance	6806	90.87	21.52	-40.04	86.95	94.68	98.93	408.56

### 3.1.2.3. Correlation Heatmap

The system shall provide a correlation heatmap of the dataset on the Analyze Page. Users can leverage this information while training ML models. The heatmap shall display:

- Direct Proportionality:** A value of 1 indicates a direct proportionality between two attributes.
- Indirect Proportionality:** A value of -1 indicates an indirect proportionality between two attributes.
- No Relationship:** A value of 0 indicates no relationship between two attributes.



### 3.1.2.4. Attribute-Specific Analysis

The system shall provide functionality to further analyze an attribute selected from a

dropdown menu. Upon selecting an attribute, the system shall compute the following checks:



**3.1.2.4.1. Numerical Attribute:** If the selected attribute is numerical, the system shall visualize the following panels:

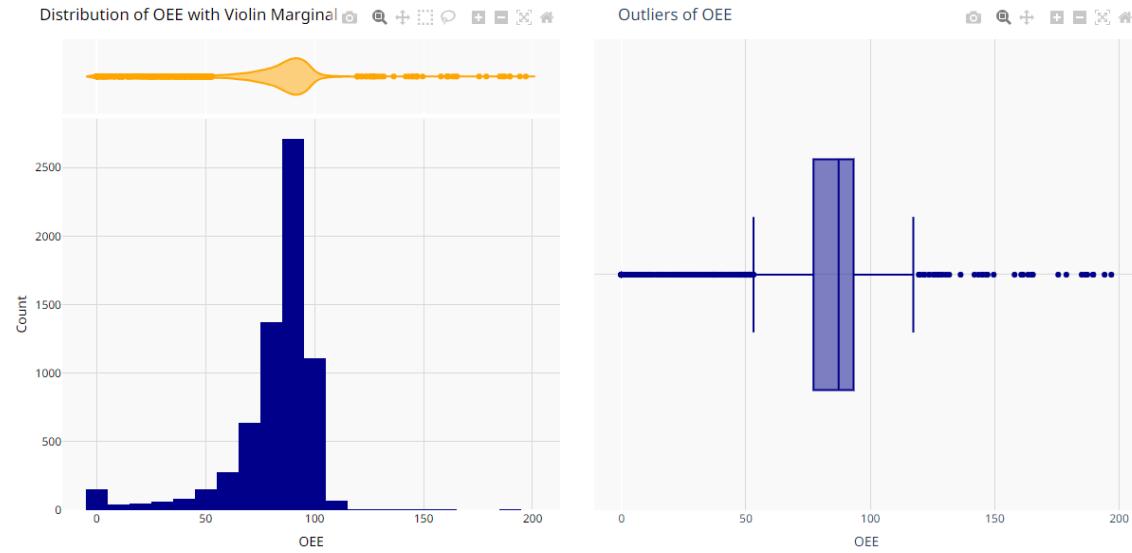
- **Distribution Chart:** Displays the frequency distribution of the dataset's values.
- **Violin Chart:** Combines a box plot with a kernel density plot to show the distribution and probability density of the data.
- **Box Plot Chart:** Summarizes the distribution of the dataset by displaying its median, quartiles, and potential outliers.

**Attribute EDA**

Select Attribute: **OEE**
**OEE**
**Attribute Description:** Calculated OEE of that specific SAP\_Order

**Charts Description:**

- **Histogram:** Displays the distribution of data points across different ranges.
- **Violin Plot:** Combines a box plot and a density plot to show the distribution and probability density.
- **Box Plot:** Summarizes the distribution with boxes representing the interquartile range and whiskers extending to show the range of the data.



**3.1.2.4.2. Categorical Attribute:** If the selected attribute is categorical, the system shall visualize the following panels:

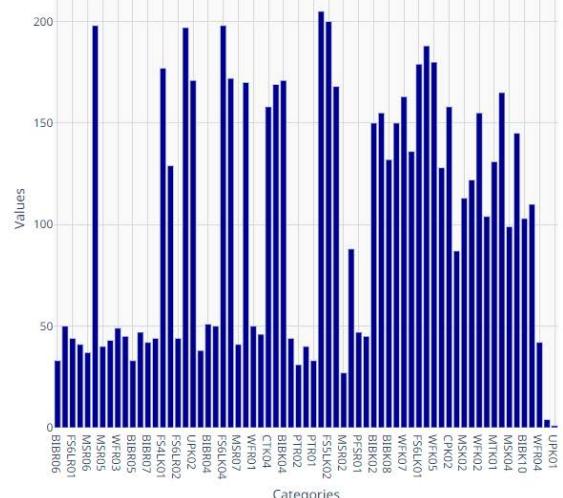
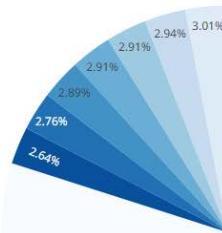
- **Pie Chart:** Displays proportions of different categories as slices of a circle.
- **Bar Chart:** Compares quantities across different categories using rectangular bars.
- **Treemap Chart:** Displays nested rectangles to show the proportion of each category.

**Attribute EDA**

Select Attribute: **WorkCenter**
**WorkCenter**
**Attribute Description:** WorkCenter at specific Plant

**Charts Description:**

- **Pie Chart:** Shows the distribution of different categories as slices of a pie.
- **Tree Map:** Displays categories as nested rectangles, giving a hierarchical view.
- **Bar Chart:** Illustrates the count or frequency of each category as bars.

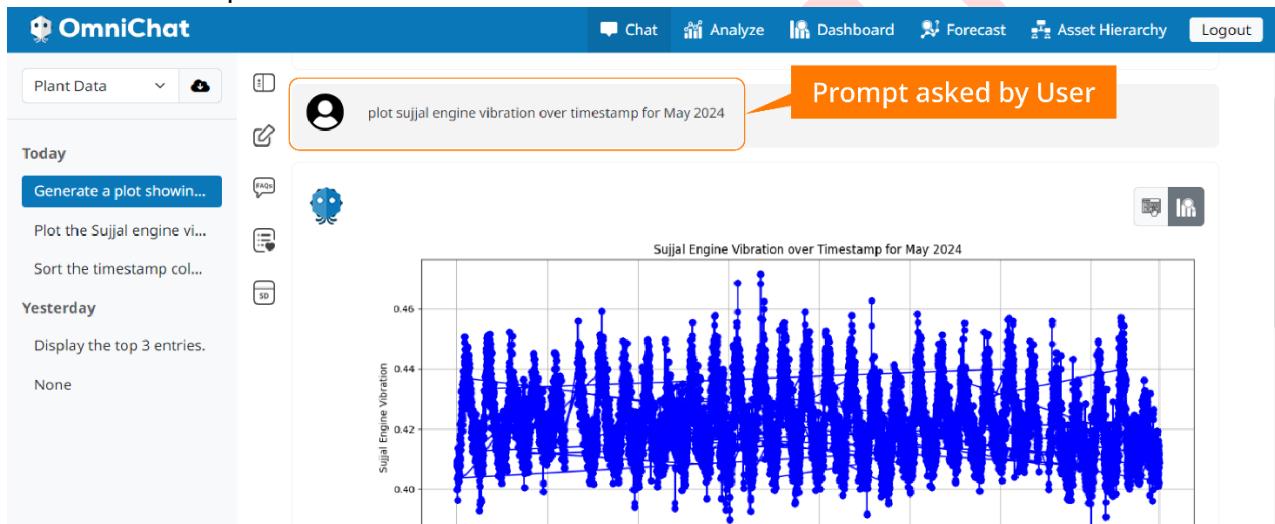


### 3.1.3. Dashboarding & Interactive Panels

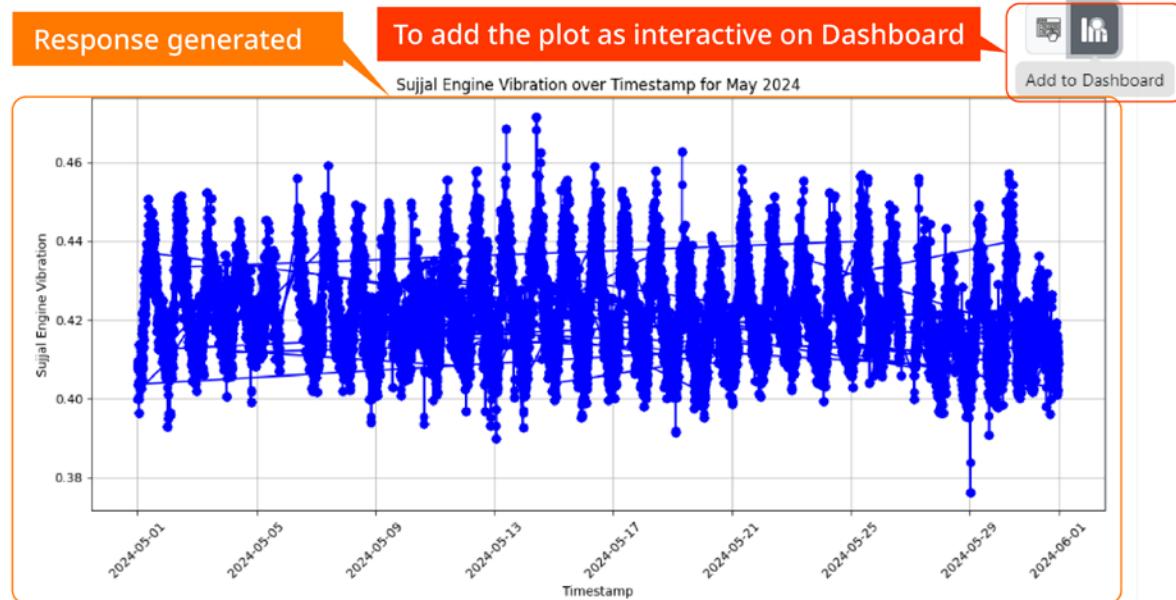
The Dashboard Page of OmniChat offers a dynamic and interactive platform for users to manage and customize their data visualizations. This page integrates seamlessly with other OmniChat features, allowing users to create and personalize their dashboards effectively.

#### 3.1.3.1. Adding Interactive Plots

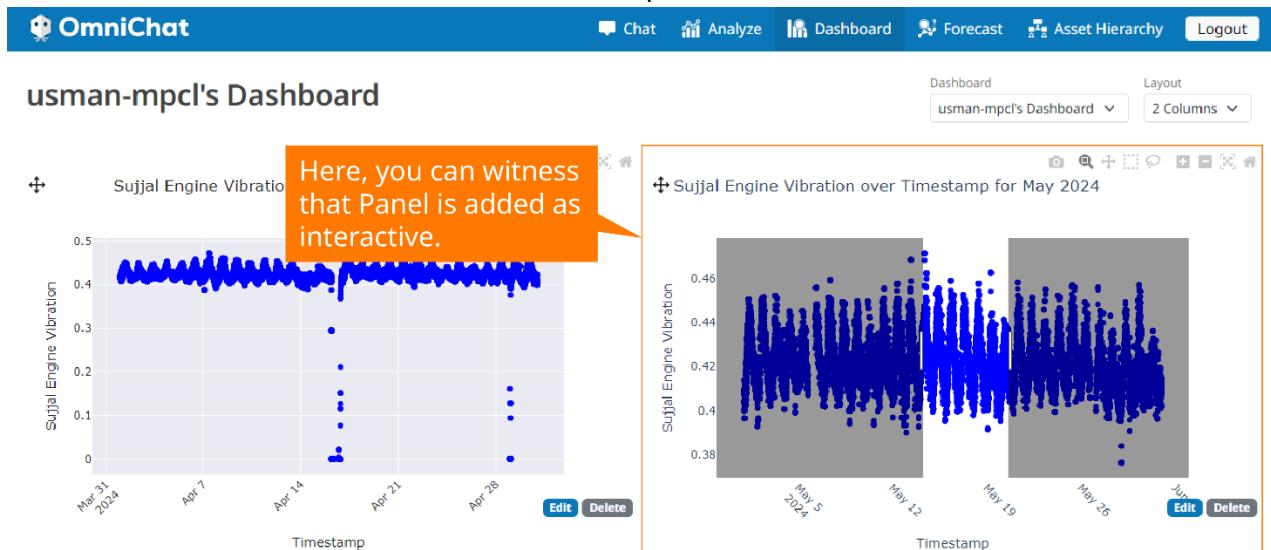
- Users can add images as interactive plots to their dashboard by clicking the "+ Add to Dashboard" button on each image on the OmniChat Chat page.
- These images are transformed into Plotly charts, providing rich interactivity and customization options.



- + **Add to Dashboard** button in upper right corner

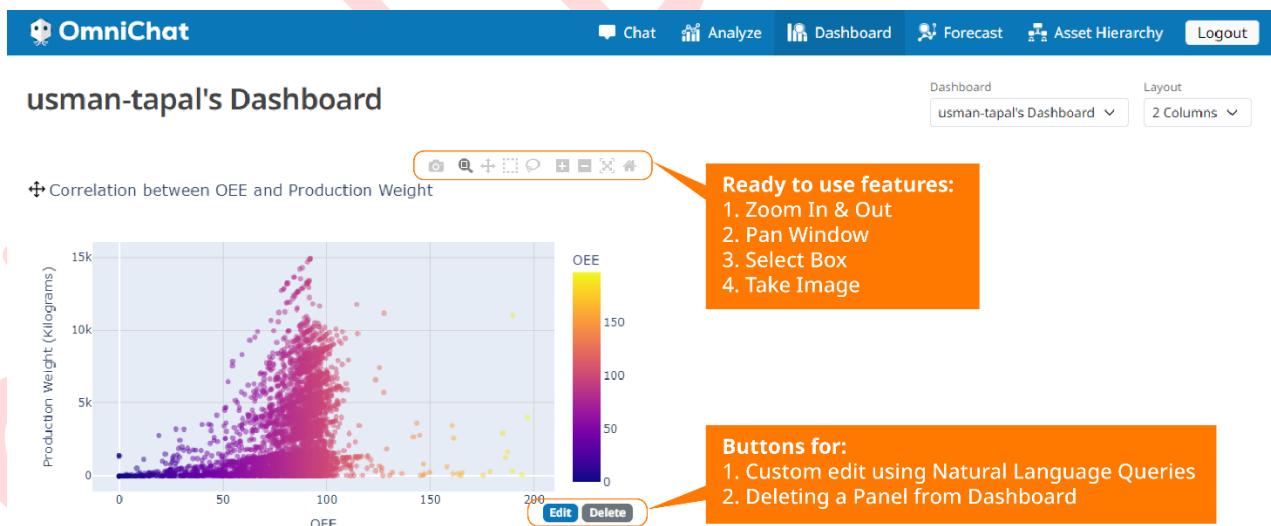


- On successful addition call, the static image is added to Dashboard page as Interactive chart. The dashboards shall be unique for all the users



### 3.1.3.2. Editing Plots Using NLP Commands

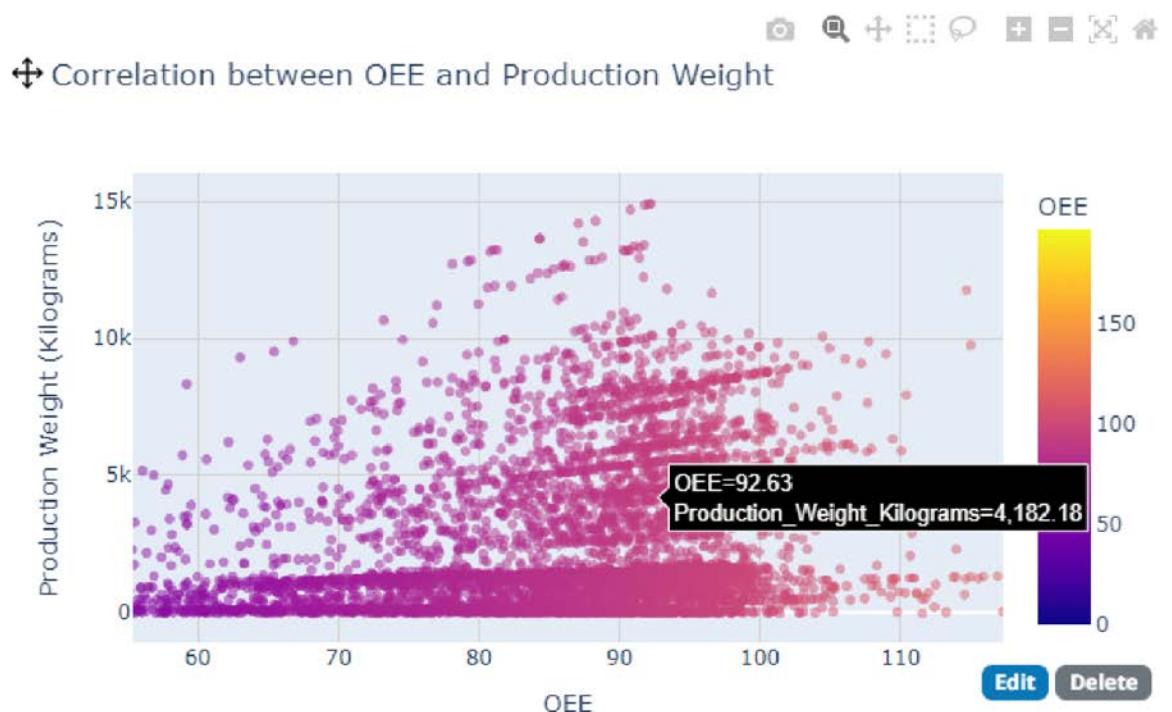
The interactive plots on the dashboard are editable using Natural Language Processing (NLP) commands. Users can make various modifications by simply typing commands, such as:



- **Zoom In & Hover** are some of the ready to use features

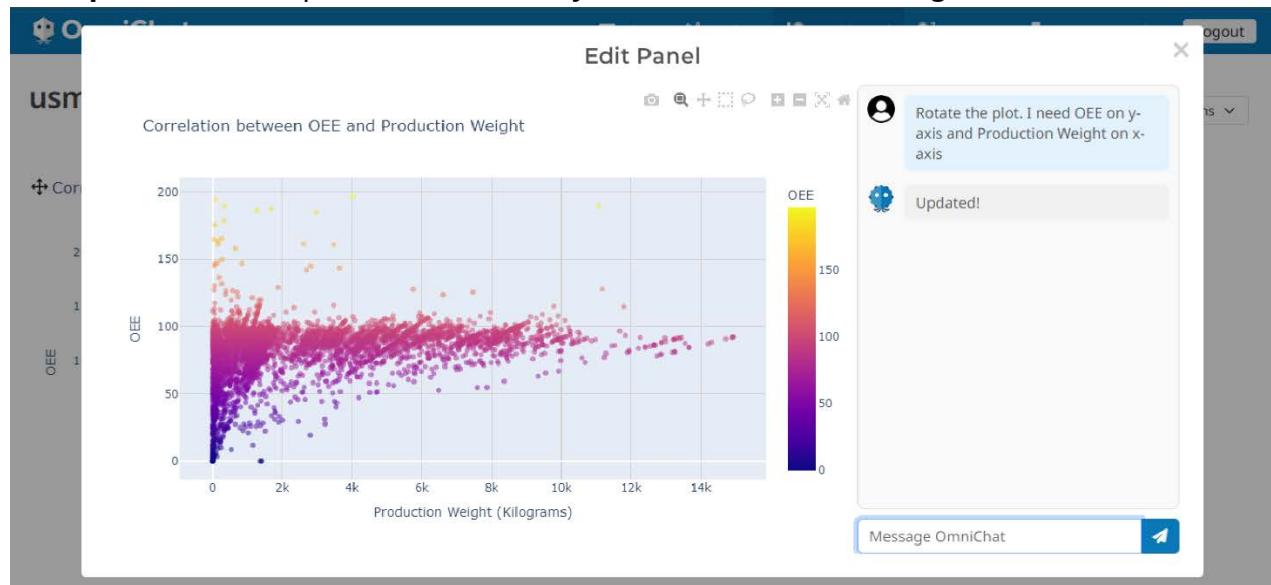


## usman-tapal's Dashboard



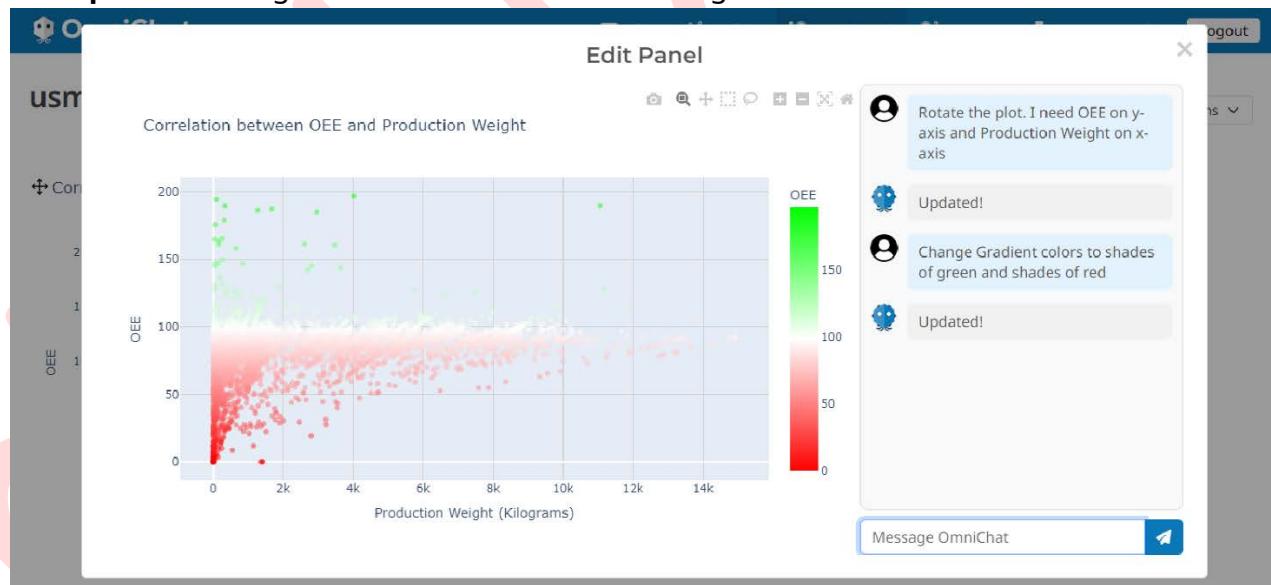
- **Rotating the Panel using Editing Feature:**

**Prompt:** "Rotate the plot. I need OEE on y-axis and Production Weight on x-axis"

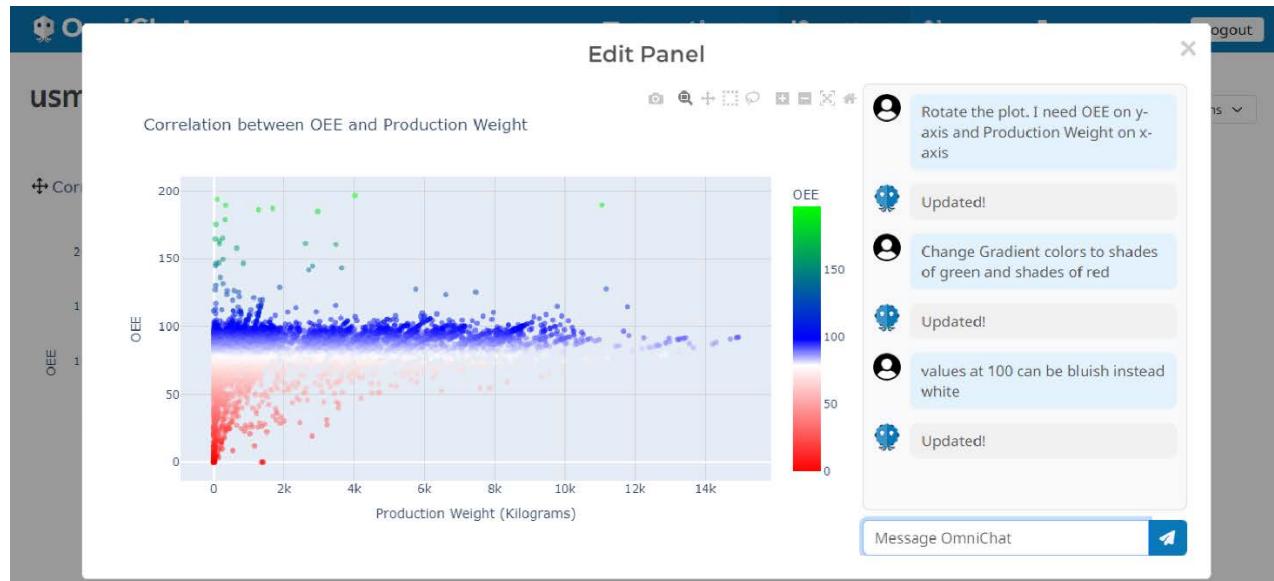


- **Changing Panel Colors using Editing Feature:**

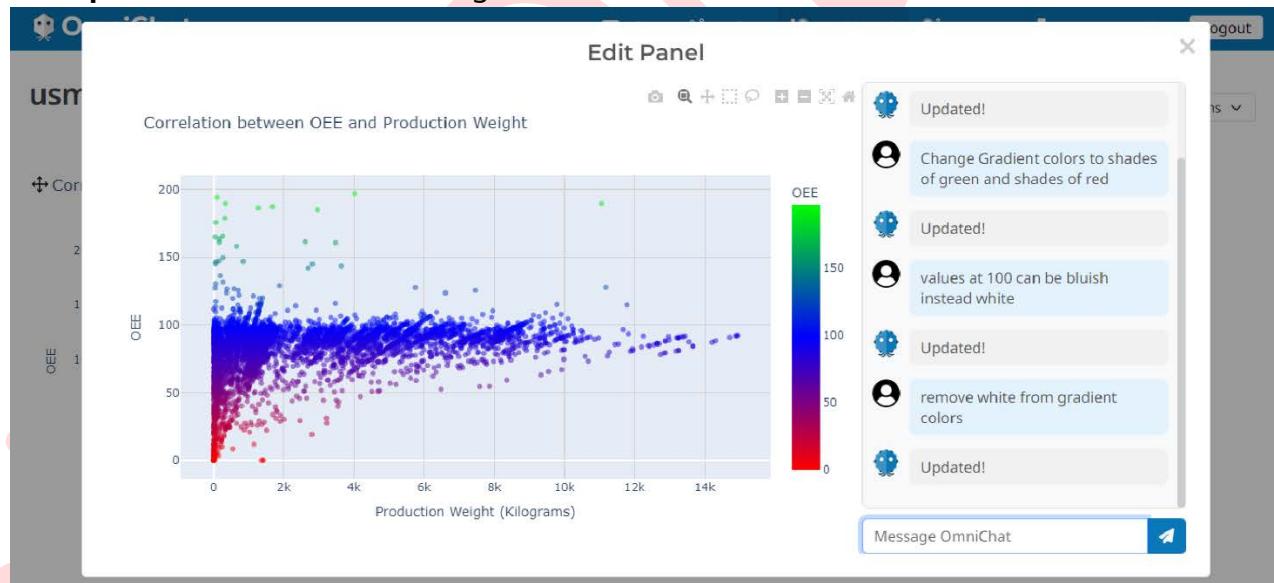
**Prompt# 1:** " Change Gradient colors to shades of green and shades of red"



**Prompt# 2:** " values at 100 can be bluish instead white"

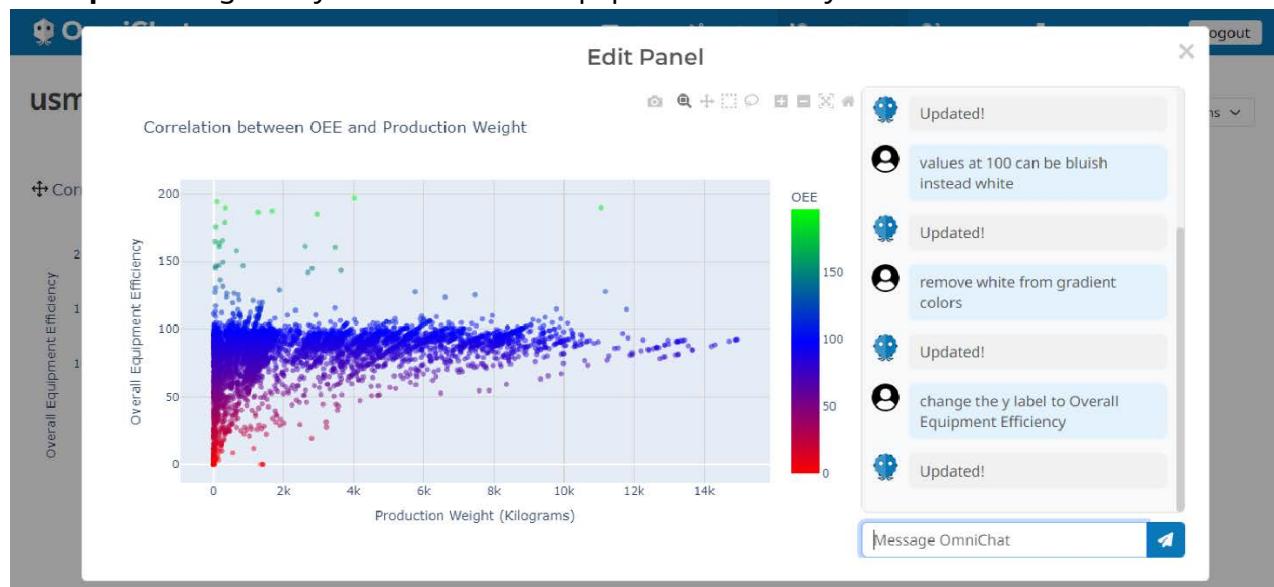


**Prompt# 3:** " remove white from gradient colors"



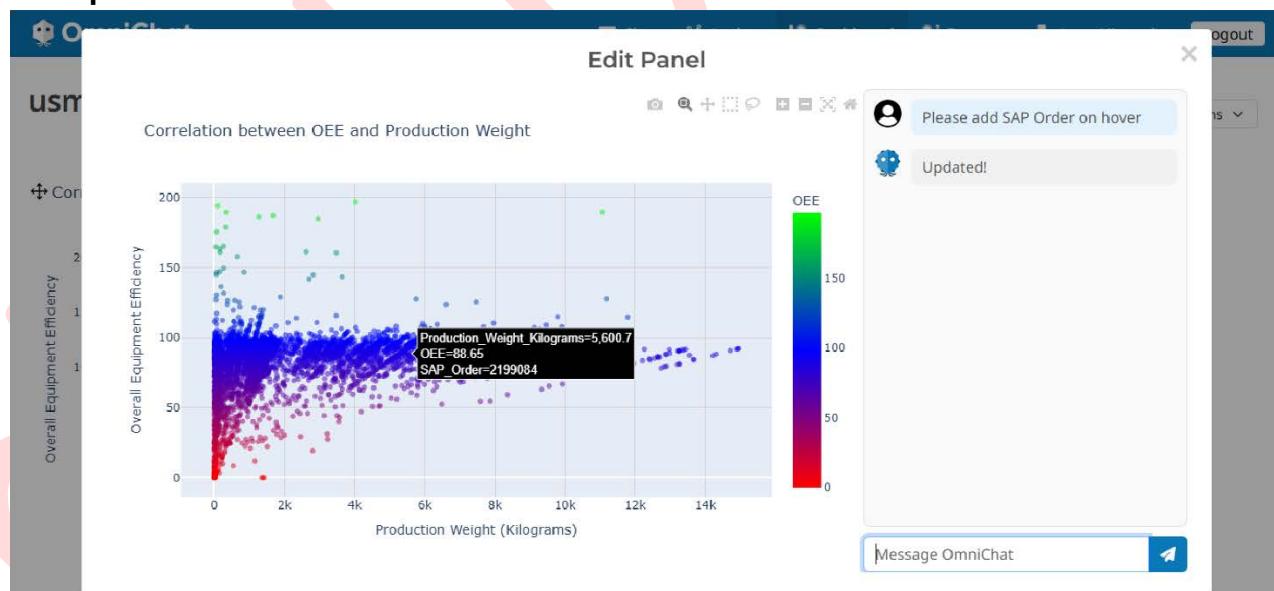
- **Changing Titles & Labels using Editing Feature:**

**Prompt:** "change the y label to Overall Equipment Efficiency"

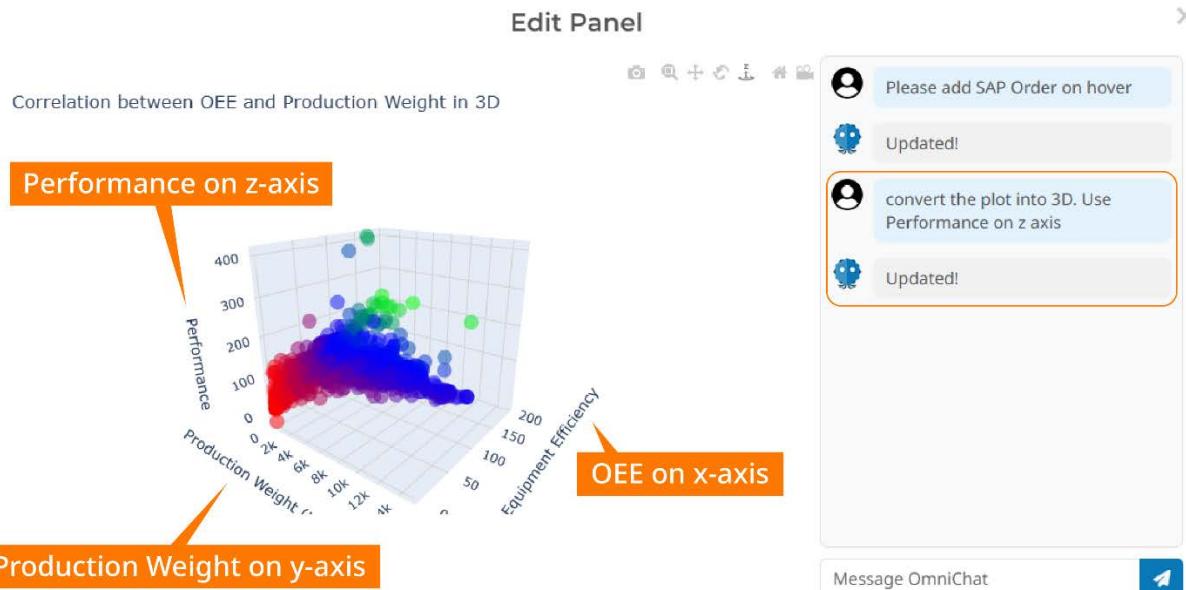


- **Adding other details in Plot using Editing Capabilities:**

**Prompt:** " Please add SAP Order on hover"

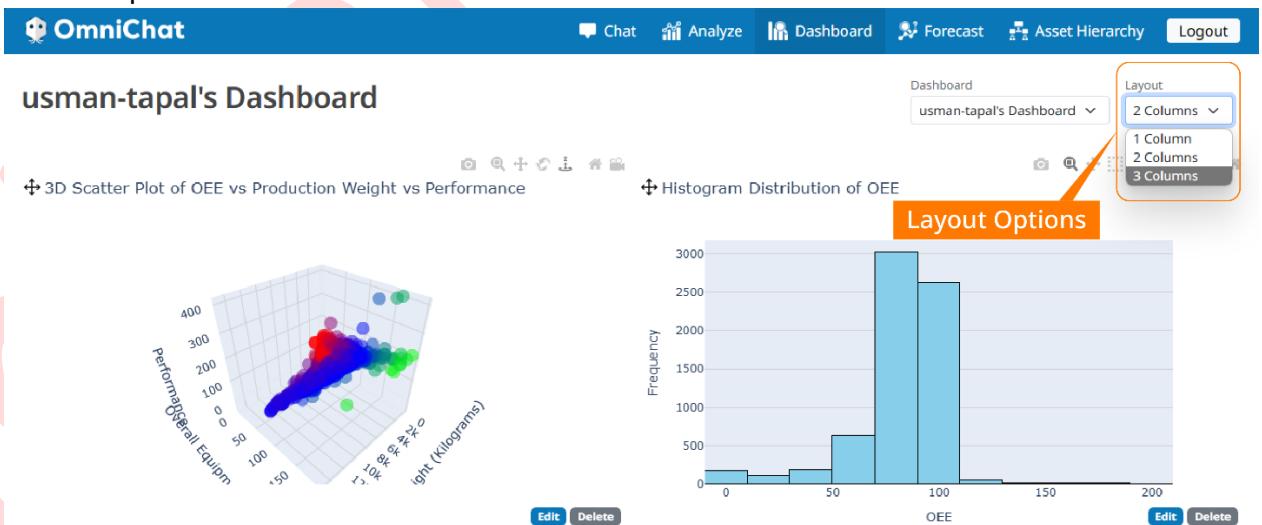


- **Converting the whole plot into 3-Dimensional Plot using Editing Capabilities:**  
**Prompt:** "convert the plot into 3D. Use Performance on z axis"



### 3.1.3.3. Customizable Layout

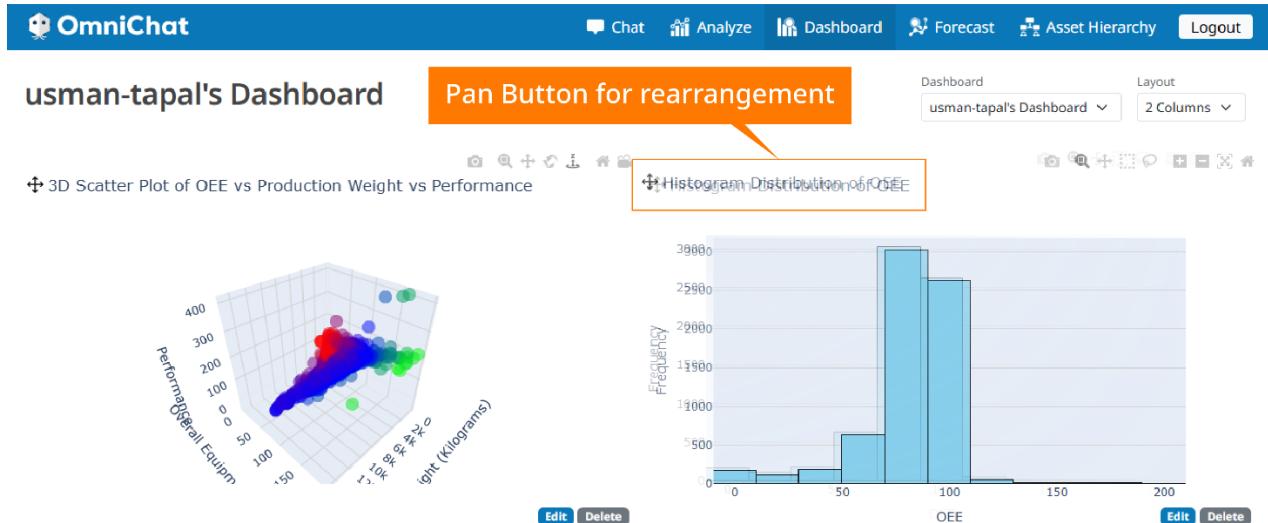
- Users can set the layout of the dashboard to fit their preferences and needs.
- Options include arranging the dashboard in 1 column per row, 2 columns per row, or 3 columns per row.



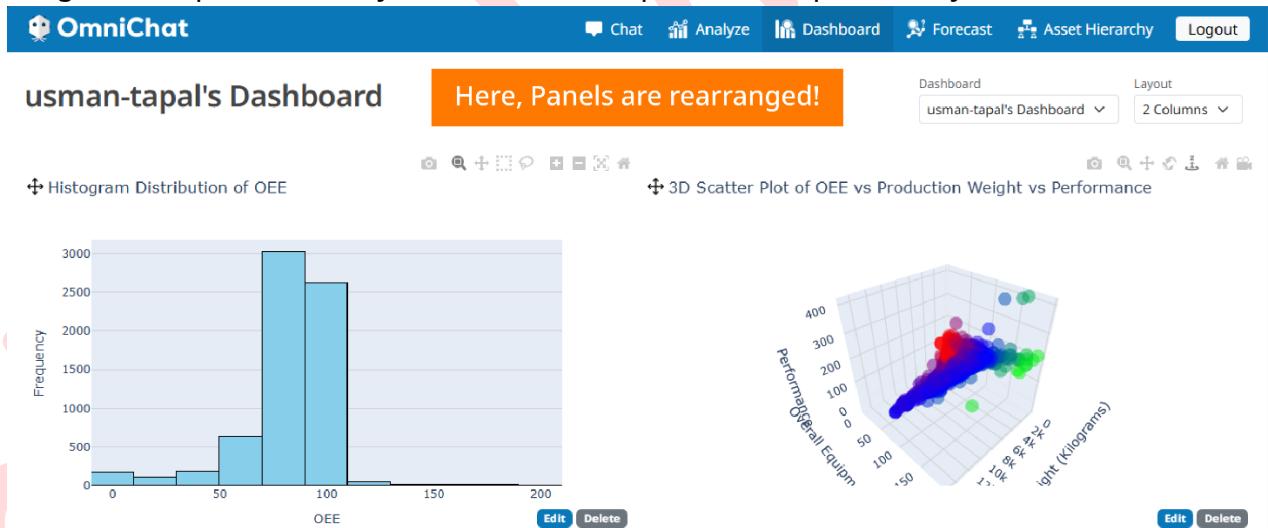
### 3.1.3.4. Arranging Plots on the Dashboard



- Users have the flexibility to arrange the plots on the dashboard, enabling a personalized and organized view.



- Drag-and-drop functionality allows users to reposition the plots easily.



### 3.1.3.5. Interacting with IoT/OT/Sensors Data

- The system shall allow users to interact with IoT/OT/Sensors data over Timestamp.
- This interaction enhances real-time data analysis and monitoring capabilities.

### 3.1.3.6. Creating New Dashboards

- Users can create new dashboards from the main dashboard interface.
- Each plot panel includes a "Move to another dashboard" button, allowing users to transfer plots to different dashboards seamlessly.



### 3.1.4. Forecast Data

The Forecast Data Page in OmniChat provides users with advanced machine learning capabilities to predict future values of selected attributes from various datasets. This page leverages AutoML modules to streamline the forecasting process, offering detailed insights and interactive visualizations.

#### 3.1.4.1. Dataset Selection

The system shall provide a dropdown menu for users to select the dataset type. Users can choose between:

- OT data/Sensor data
- Business data (e.g., finance data)

#### 3.1.4.2. Attribute Selection

- Upon selecting a dataset, the system shall prompt users to choose the specific attribute they want to predict.
- This attribute shall be selected from a dropdown menu containing all available attributes in the chosen dataset.

#### 3.1.4.3. AutoML Forecasting Process

After selecting the attribute to predict, the system shall initiate the AutoML process.

The system shall provide a detailed verbose output of the AutoML process, including:

- Data splitting into test, train, and validation sets
- Machine learning models used
- Accuracies and performance metrics of each model

#### 3.1.4.4. Confusion Matrix

The system shall generate a confusion matrix along with key metrics such as:

- **Accuracy:** The proportion of correctly predicted instances out of the total instances.
- **Precision:** The proportion of true positive predictions out of the total predicted positives.
- **Recall:** The proportion of true positive predictions out of the total actual positives.
- **F1 Score:** The harmonic mean of precision and recall, balancing the two metrics.

#### 3.1.4.5. Interactive Visualization of Best ML Model

The system shall identify the ML model with the best accuracy. The results of this model shall be visualized using interactive plots. For instance:

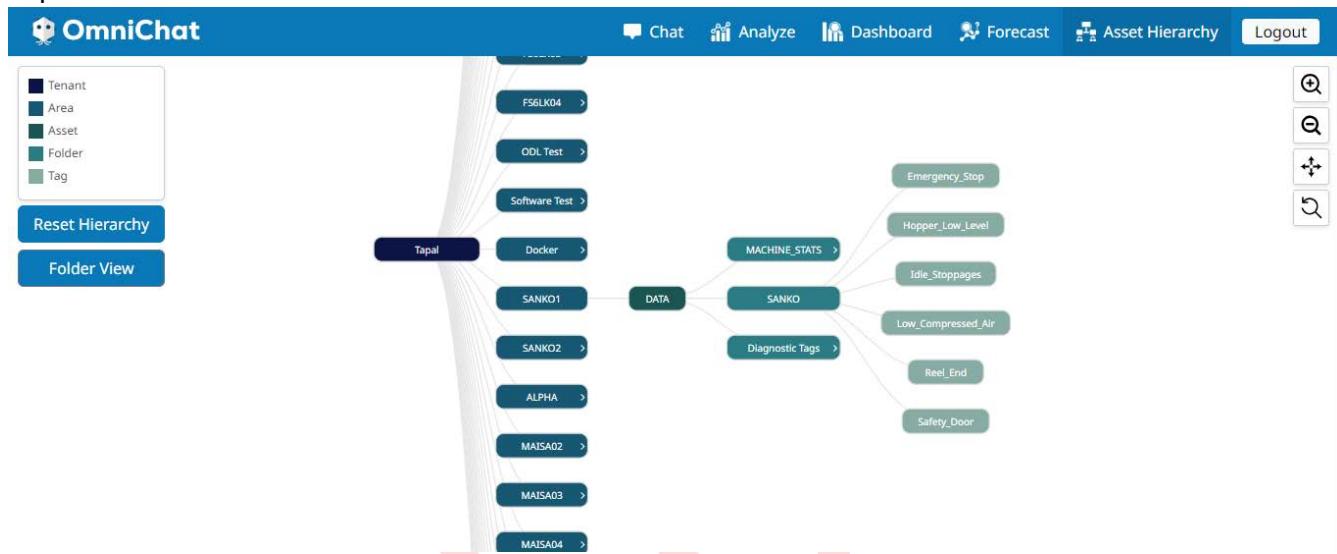
- **For IoT/Sensor data:** Time series plots displaying the predicted values over time
- **For Business data:** Appropriate visualizations like line charts, bar charts, or other relevant business data plots

#### 3.1.4.6. ML Model Decision Making

- The detailed verbose output of the AutoML process shall be accessible in a popup window.
- Users can review the step-by-step process and metrics used during the forecasting.

### 3.1.5. Asset Hierarchy for OT/Sensor Data

The Asset Hierarchy page of OmniChat is designed to provide an intuitive and interactive visualization of asset hierarchy data. This page leverages the OmniConnect Read API to fetch and display a structured representation of assets, enhancing user experience and data management capabilities.



#### 3.1.5.1. Data Integration via OmniConnect Read API

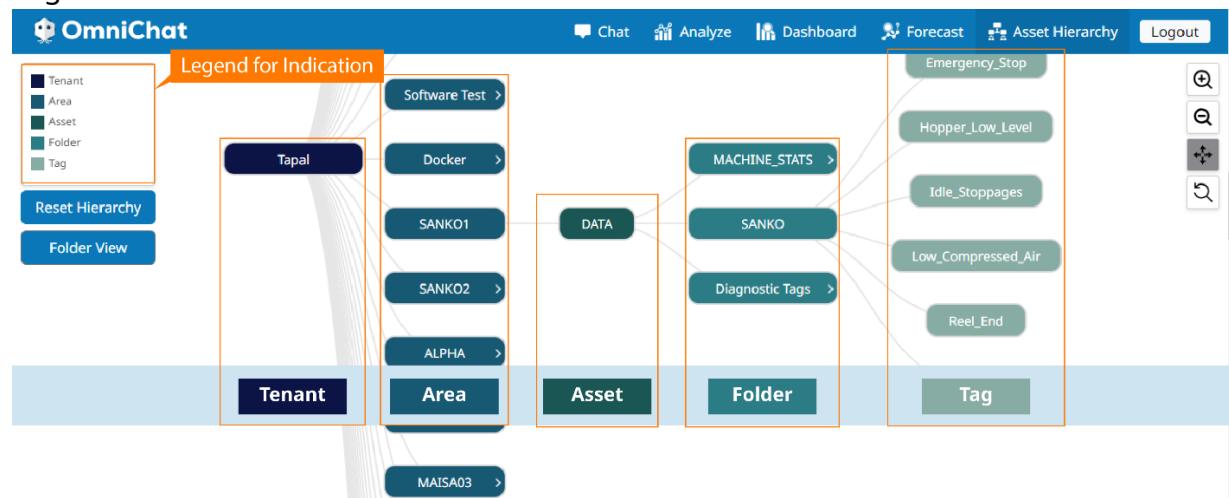
- The system pulls asset hierarchy data from OmniConnect using the OmniConnect Read API.
- The fetched data file undergoes necessary transformations to visualize nodes structured as Tenant, Area, Asset, Folder, and Tag.

#### 3.1.5.2. Hierarchical Visualization

The transformed data is visualized in a hierarchical structure, with nodes representing different levels:

- Tenant
- Area
- Asset
- Folder

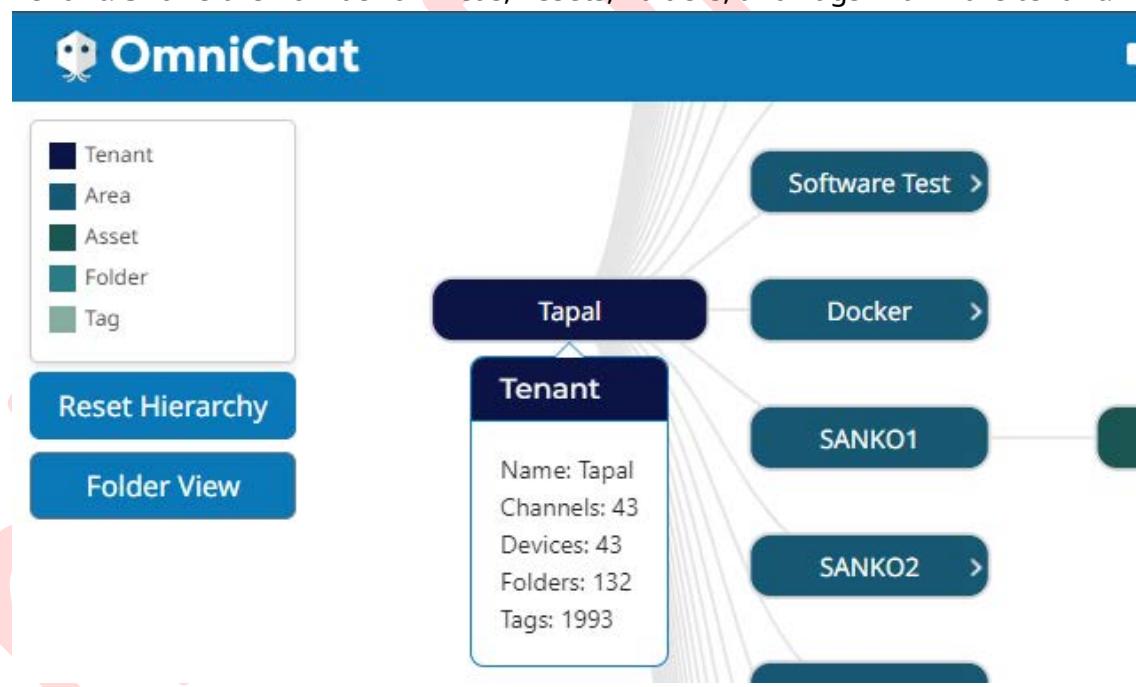
- Tag



### 3.1.5.3. Interactive Node Information

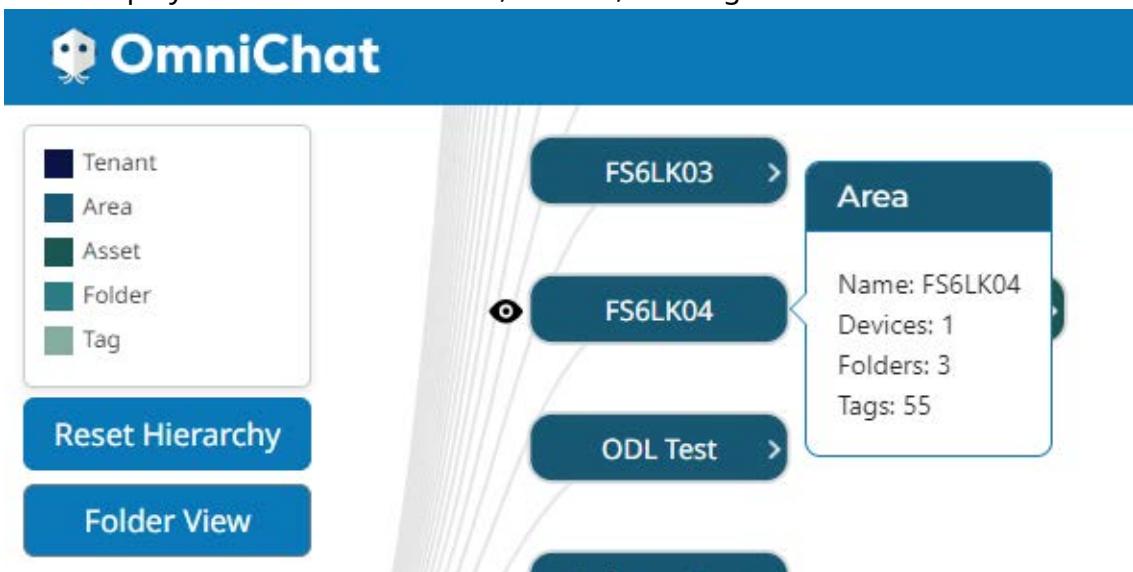
Each node in the hierarchy provides detailed information upon hovering:

- Tenant: Shows the number of Areas, Assets, Folders, and Tags within the tenant.

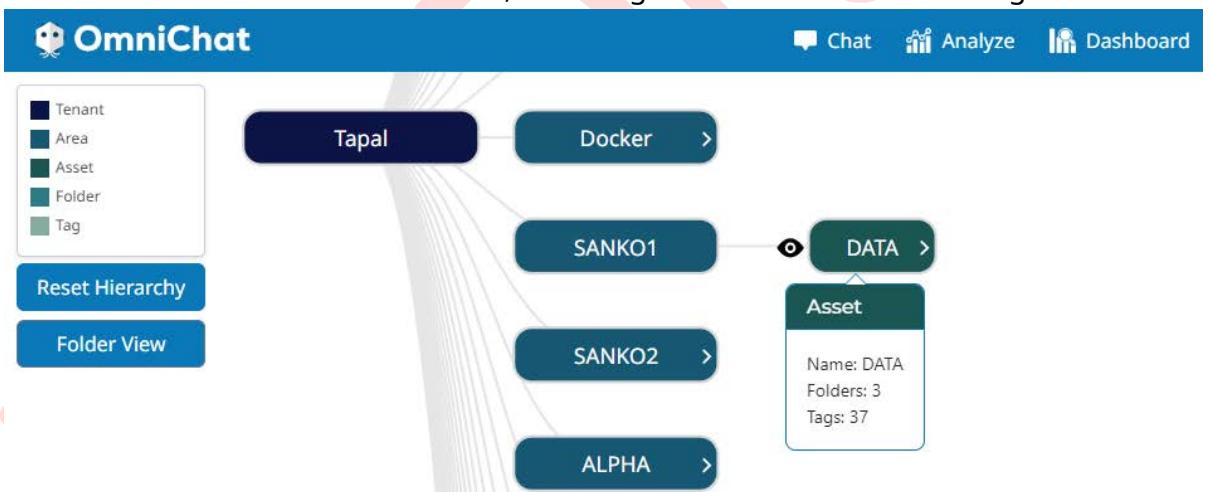




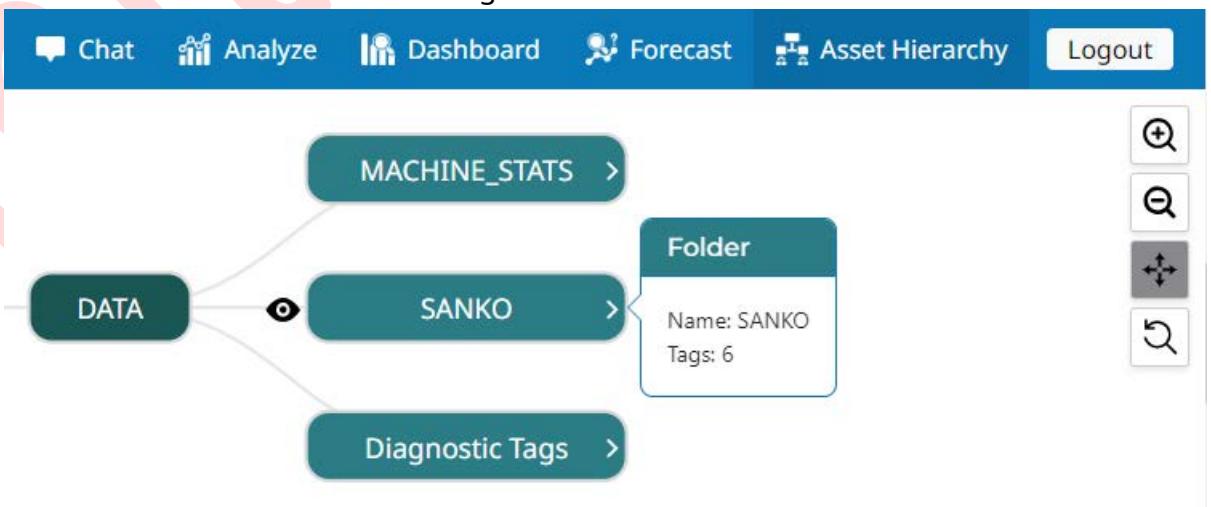
- Area: Displays the number of Assets, Folders, and Tags within the area.



- Asset: Shows details about the Asset, including associated Folders and Tags.



- Folder: Indicates the number of Tags within the folder.

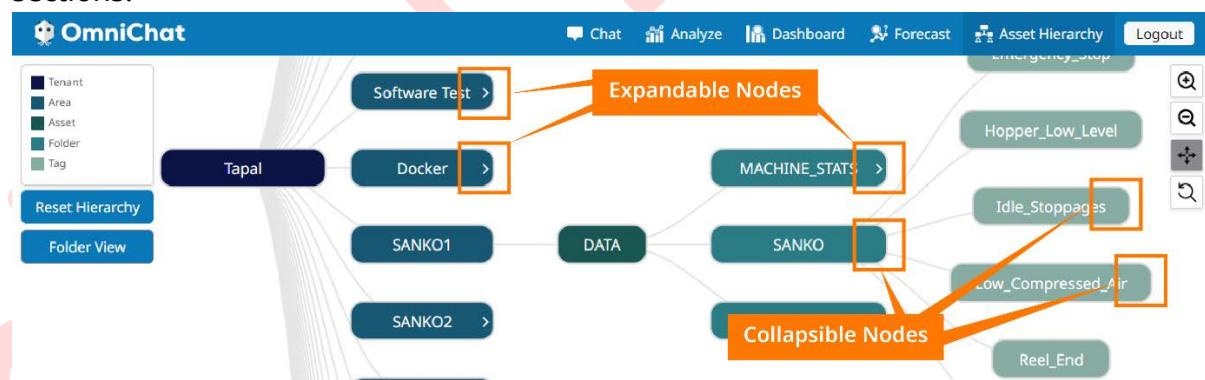


- Tag: Displays the Tag Name and Tag Path (e.g., Tenant.Area.Asset.Folder).



#### 3.1.5.4. Expandable and Collapsible Nodes

- Nodes in the hierarchy are expandable, enhancing the interactive front-end experience of the Asset Hierarchy page.
- Expandable nodes feature an icon indicating their expandability, allowing users to expand or collapse nodes as needed.
- Users can collapse expanded nodes to streamline the view and focus on specific sections.

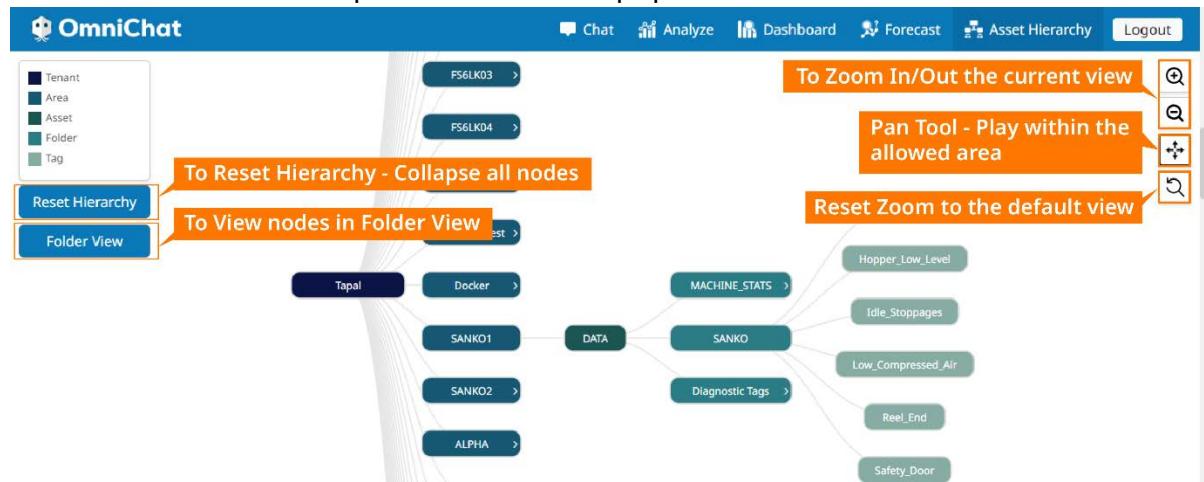


#### 3.1.5.5. User Interface Controls

The Asset Hierarchy window includes the following controls:

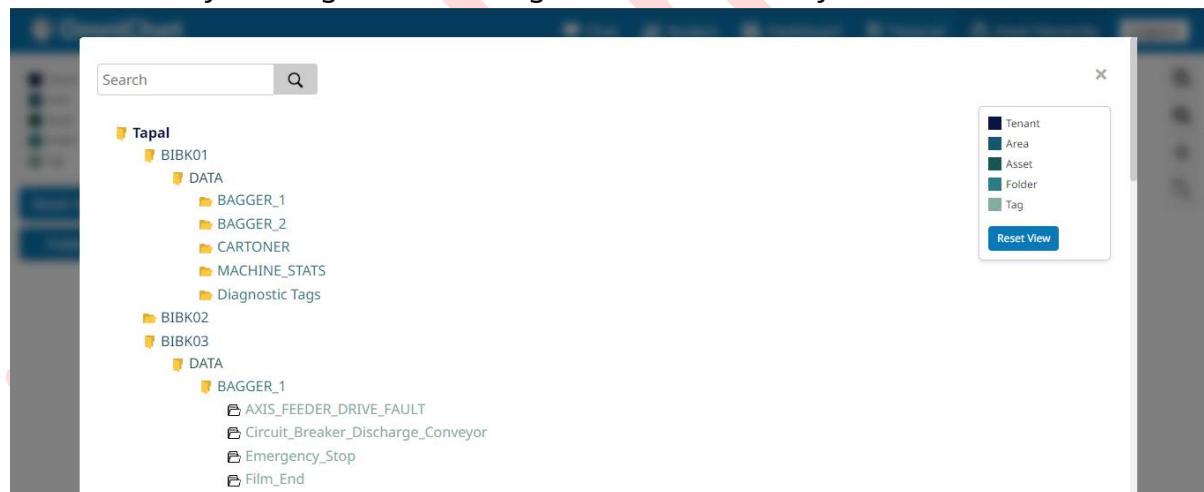
- **Reset Hierarchy:** Resets the view to show only the main Tenant node, with all other nodes collapsed.
- **Zoom In and Zoom Out:** Allows users to adjust the zoom level for a detailed or broader view of the hierarchy.
- **Pan:** Enables users to navigate within the viewing area.
- **Reset Zoom:** Resets the zoom level to the default viewing window.

- **Folder View:** Button to open Folder View Popup



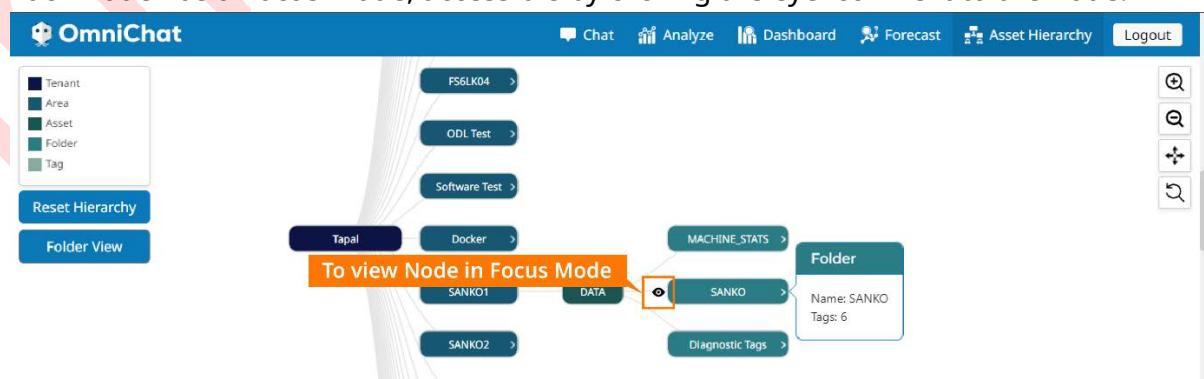
### 3.1.5.6. Folder View Popover

- A Folder View button opens a popover, providing a directory-style view of the nodes.
- This directory view resembles the structure of directories in a file explorer, offering an alternative way to navigate and manage the asset hierarchy.



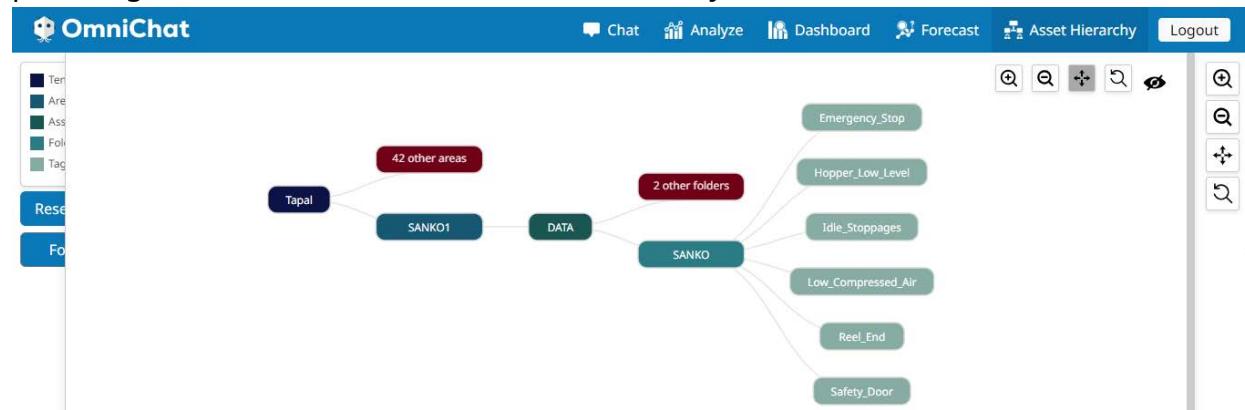
### 3.1.5.7. Focus Mode

- Each node has a Focus Mode, accessible by clicking the eye icon next to the node.



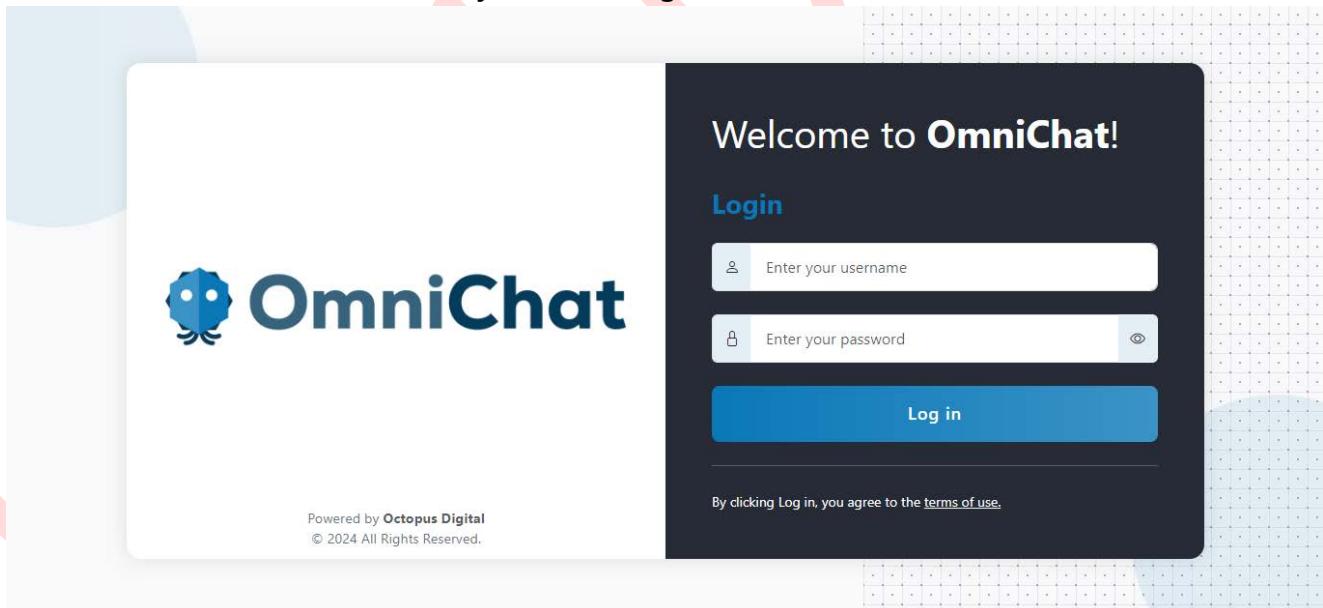


- This opens a popup displaying the parent and child nodes of the selected node, providing a detailed view of its immediate hierarchy.



### 3.1.6. Authentication, Security, and Configuration Management

The OmniChat Authentication, Security, and Configuration Management page is meticulously designed to provide a secure and robust authentication mechanism for users, while also offering comprehensive tools for user management and system configuration. This page plays a crucial role in safeguarding sensitive information, maintaining the integrity of user data, and enabling efficient user administration and system training.



#### 3.1.6.1. User Authentication and Verification

- **Secure Login Credentials:** Users are required to enter their unique username and password to access the system. Passwords are securely hashed to protect user credentials against unauthorized access.

#### 3.1.6.2. Enhanced Security Features

- **Forget Username:** Users can retrieve their username by providing their registered email address, ensuring a smooth recovery process.



- **Forget Password:** Users can reset their password by receiving a secure reset link via email, protecting their account from unauthorized access.
- **Sign Up:** New users can create an account by providing necessary details and confirming their email address, ensuring the authenticity of new accounts.
- **2-Factor Authentication:** For an added layer of security, users must complete a second authentication step, such as entering a code sent to their registered mobile number or email address, thereby reducing the risk of unauthorized access.

#### 3.1.6.3. Seamless Navigation

- **Post-Authentication Redirect:** After successful login and completion of any required 2-factor authentication, users are automatically redirected to the Chat page, where they can interact with OmniAgent and access historical chats, ensuring a smooth transition and user experience.

#### 3.1.6.4. Organization Admin Page

- **User Management:** Admins will have access to a dedicated page for managing user accounts, including adding, editing, and removing users, ensuring effective user administration and security.
- **Training OmniAgent:** Admins can access a training page to provide new data and fine-tune OmniAgent, ensuring the system remains up-to-date and capable of meeting organizational needs.

## 3.2. Non-Functional Requirements

### 3.2.1. Interface Requirements

#### 3.2.1.1. User-Friendly and Intuitive Interface

The system shall provide a user-friendly and intuitive interface to facilitate ease of use and accessibility for all users.

#### 3.2.1.2. Light Background Color for Visualizations

Visualization elements shall use a light background color (e.g., #f0f0f0) to enhance readability and aesthetics.

#### 3.2.1.3. Responsive and Accessible Interface

The interface shall be responsive and accessible on various devices, ensuring usability across desktops, tablets, and mobile phones.

#### 3.2.1.4. Customization Options for Visual Elements

Customization options shall be provided for visual elements to allow users to tailor their viewing experience based on specific preferences and requirements.

### 3.2.2. Availability Requirements

#### 3.2.2.1. High Availability with Minimal Downtime

The system shall ensure high availability with minimal downtime to support continuous operations and uninterrupted access to critical functionalities.

#### 3.2.2.2. Failover and Redundancy Mechanisms

It shall support failover and redundancy mechanisms to maintain service availability in case of hardware or software failures.

### 3.2.3. Security Requirements

#### 3.2.3.1. User Authentication and Authorization

Robust user authentication and authorization mechanisms shall be implemented to control access and protect user data from unauthorized use.

#### 3.2.3.2. Encryption of Sensitive Data

Sensitive data shall be encrypted both at rest and in transit to prevent unauthorized access and ensure data confidentiality.

#### 3.2.3.3. Compliance with Data Protection Regulations

The system shall comply with relevant data protection regulations, such as GDPR, to safeguard user privacy and rights regarding personal data.

### 3.2.4. Performance Requirements

#### 3.2.4.1. Processing and Visualization of Large Datasets

The system shall process and visualize datasets up to 1GB within 5 minutes to ensure efficient handling of large-scale data analysis tasks.

#### 3.2.4.2. Real-Time Data Updates

It shall support real-time data updates and display to provide users with up-to-date information and insights without delay.



### 3.2.4.3. Quick Response Times

The system shall provide quick response times for data processing and analysis to enable timely decision-making and interactive user experiences.

Initial Draft